

# From Algebra to Zoology

How Well Do Students Report Mathematics  
and Science Coursetaking?

NCES 2020-037  
U.S. DEPARTMENT OF EDUCATION

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The High School Transcript Study (HSTS) collects and analyzes transcripts from a representative sample of U.S. public and private high school graduates. The study is designed to inform the public about the types of courses that graduates take during high school, how many credits they earn, and their grade point averages (GPAs). The HSTS also explores the relationship between coursetaking patterns and student achievement, as measured by the National Assessment of Educational Progress (NAEP). High school transcript studies have been conducted periodically for nearly two decades, permitting the reporting of trends in coursetaking and GPA, as well as providing information about recent high school graduates. In addition to collecting transcripts, the HSTS collects student information such as gender, graduation status, race/ethnicity, and information about the schools studied.

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# From Algebra to Zoology

How Well Do Students Report Mathematics and Science Course-taking?

**APRIL 2020**

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NCES 2020-037

U.S. DEPARTMENT OF EDUCATION



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# EXECUTIVE SUMMARY

The National Assessment of Educational Progress (NAEP) reports how well elementary and secondary school students across the United States perform in a variety of academic subjects. NAEP also asks students about their educational experiences and demographic information to better understand their assessment scores. Much of the student information on demographics, classroom experiences, and coursetaking is self-reported; that is, students answer the survey questions that are in their test booklets after they complete the assessment questions. While student self-reported information provides valuable data for NAEP analyses, and is often the only source of these data, it is helpful to examine how accurately students report their data. Comparing student responses with other available educational data is one straightforward way of measuring the validity of student-reported data (Shettle, Roey, and Perkins 2005).

This study measures the validity of the mathematics and science coursetaking information reported by high school students by comparing it to information obtained from the NAEP High School Transcript Study (HSTS). The HSTS is an administrative data collection of transcripts belonging to high school graduates who took the NAEP twelfth-grade mathematics and science assessments. The HSTS provides NAEP with an opportunity to compare the official coursework recorded on students' high school transcripts to their self-reported high school coursetaking and identify any differences. Such differences are important to consider when exploring the relationship between student-reported coursetaking and other measures of

student educational performance, such as NAEP twelfth-grade assessment scores.

This study focuses on mathematics and science courses, which are the two subjects for which NAEP asks for detailed information from students about their coursetaking. The mathematics and science courses that students reported taking as part of the NAEP twelfth-grade mathematics and science assessments in 2000, 2005, and 2009 were compared to the mathematics and science courses recorded on their high school transcripts from the same years. Primary emphasis is given to results from 2009, the most recent administration of the HSTS. Besides describing how well student and transcript sources align, this report looks at the effects of using student-reported data in common coursetaking measures and analyses, including the relationship between coursetaking and NAEP assessment scores. The study findings are summarized here and described in detail in the body of the report.

When comparing mathematics courses reported by high school students in 2009 to the mathematics courses recorded on their high school transcripts, the major findings are as follows:

- ♦ For all mathematics courses, except precalculus and unified/integrated mathematics, the percentage of students who reported taking the course was higher than the percentage recorded on the students' transcripts (percentage difference ranged from about 1.5 to 20 points).
- ♦ At least 85 percent of students' self-reports of algebra I, geometry, and algebra II courses taken matched their high school transcripts.

- ♦ For 6 of the 12 mathematics courses, about 60 percent or more of students reported taking courses that were not recorded on their high school transcripts.
- ♦ For each of the five mathematics courses generally taken after algebra II, at least 90 percent of students correctly reported the most recent grade the course was taken.
- ♦ For the mathematics courses generally taken before algebra I, the percentage of students who reported the most recent grades the courses were taken as listed on their transcripts ranged from 37 percent to 69 percent.
- ♦ Thirty percent of students reported all of the mathematics courses recorded on their transcripts.

When comparing science courses reported by high school students in 2009 to the science courses recorded on their high school transcripts, the major findings are as follows:

- ♦ For all science courses, with the exception of first- and second-year biology courses and first-year chemistry courses, the percentage of students who reported taking the course was higher than the percentage recorded on the students' transcripts (percentage difference ranged from about 2 to 34 points).
- ♦ At least 90 percent of students' self-reports of first-year biology, chemistry, and physics courses taken matched their high school transcripts.
- ♦ For 5 of the 11 science courses, about 60 percent or more of students reported taking courses that were not recorded on their high school transcripts.

- ♦ At least 90 percent of students correctly reported the most recent grades that chemistry and physics courses were taken.
- ♦ For science courses generally taken in the first year of high school, the percentage of students who reported the most recent grades the courses were taken as listed on their transcripts ranged from 44 percent to 86 percent.
- ♦ About 19 percent of students reported all of the science courses recorded on their transcripts.

When comparing common coursetaking measures for high school students in 2009 based on student-reported and transcript-recorded course information, including analysis of the relationship between coursetaking and NAEP assessment scores, the major findings are as follows:

- ♦ Higher percentages of students reported advanced mathematics and calculus as their highest-level mathematics courses taken than was indicated by their transcripts (41 percent versus 38 percent, and 22 percent versus 19 percent, respectively).
- ♦ A higher percentage of students reported physics as their highest-level science course taken than was recorded on their transcripts (24 percent versus 21 percent), while a lower percentage of students reported biology as their highest-level science course taken than was recorded on their transcripts (10 percent versus 15 percent).
- ♦ For algebra I, algebra II, and geometry, both the student-reported and transcript-recorded data agreed on the most common grade these courses were last taken (ninth, eleventh, and tenth grades, respectively).

- ♦ For first-year biology and chemistry courses, both the student-reported and transcript-recorded data agreed on the most common grade these courses were last taken (tenth and eleventh grades, respectively).
- ♦ The mean NAEP twelfth-grade mathematics assessment scores for students who reported taking probability/statistics and calculus courses were lower than the mean scores for students whose transcripts recorded the courses (166 versus 175, and 189 versus 193, respectively).
- ♦ The mean NAEP twelfth-grade science assessment scores for students who reported taking second-year laboratory science scores were lower than the mean scores for students whose transcripts recorded the courses (differences ranged from 10 to 29 points).
- ♦ NAEP mathematics assessment scores were lower for students who reported advanced mathematics or calculus as their highest-level mathematics course taken than for students whose transcripts indicated advanced mathematics or calculus as the highest-level mathematics course taken (160 versus 162 for advanced mathematics; 185 versus 193 for calculus).

- ♦ Students who reported taking advanced science courses as their highest-level science course taken had lower NAEP science assessment scores than students whose transcripts recorded advanced science courses (159 and 167, respectively).

The NAEP program is aware that student-reported coursetaking data may be problematic and, therefore, regularly evaluates the self-reported coursetaking questions to identify ways to reduce recall error, misunderstanding, and response bias. Research will continue to identify possible improvements in collecting self-reported coursetaking data. This report suggests that researchers consider using transcript data as the primary source when reporting student coursetaking information, and when transcript data are not available or feasible, student-reported coursetaking information be used with an acknowledgement of the potential limitations to self-reported data.



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# OVERVIEW

This study uses high school transcript data from the NAEP HSTS to determine the validity of student-reported high school courses on the NAEP twelfth-grade student questionnaire. Comparing the courses students reported taking to the courses recorded on their transcripts, which are the students' official records of high school coursework, determines the accuracy of the students' reports. Given that the HSTS is not administered as part of every NAEP twelfth-grade assessment, self-reported course data are often used to better understand NAEP assessment findings; therefore, it is important to determine the validity of these data. Using multiple administrations of HSTS, this study also investigates whether student course reporting has changed over time.

The report also examines how self-reported courses may affect the reporting of outcome measures, such as the relationship between coursetaking and achievement as reported on NAEP. The more courses a student takes within a subject, such as mathematics or science, the more content they cover within the subject, which improves their ability to correctly answer questions and generally obtain higher scores on the NAEP assessments. Students who report courses they did not take, however, have not learned the content from those courses. Therefore, their assessment scores will likely be lower than students who did take those courses. For analysts looking at NAEP assessment scores by whether or not students took those courses, students who incorrectly reported taking a course may bring down the average national scores for students who took

those courses and misrepresent the relationship between school coursetaking and achievement.

Other research studies have assessed the validity of high school students' self-reported coursetaking against their transcripts. Sawyer, Laing, and Houston (1988) compared students' high school courses collected on the ACT assessment registration folders with their high school transcripts. They found about an 87 percent student-reported accuracy rate among 30 selected academic, foreign language, and fine arts courses. A more recent ACT study (Sanchez and Buddin 2016) reported a median 94 percent student-reported accuracy rate across similar course categories. However, for advanced mathematics and science courses such as trigonometry, calculus, and physics, the student-reported accuracy rates ranged between 80 percent and 82 percent. Direct comparisons between this study and the ACT studies cannot be made, however, as NAEP and ACT define different categories for reporting mathematics and science courses.

## Background

This study uses two sources of information: student coursetaking information collected from the NAEP twelfth-grade mathematics and science assessments, and the NAEP HSTS. In addition to answering the questions that test their knowledge of the subject matter, NAEP students were asked about their demographic characteristics, classroom experiences, and educational support. These student questionnaires can be found in the sample questions booklets located on the National Center

for Education Statistics (NCES) website.  
<https://nces.ed.gov/nationsreportcard/about/booklets.aspx>.

As part of the student questionnaire, NAEP students were asked which mathematics or science courses they took and the most recent grades in which they took those courses. Only the mathematics and science questionnaires asked students to report detailed information about their coursetaking in those subjects. Students who took the mathematics assessment were asked about their mathematics courses, and students who took the science assessment provided information about their science courses. The coursetaking questions list a series of mathematics or science courses commonly taken in high school and ask the student to indicate the most recent grade (e.g., ninth, tenth, eleventh, or twelfth grades) the student took the course. The student could also indicate that he or she either took the course in eighth grade or earlier or never took the course. The coursetaking question focuses on the courses the student took, regardless of whether they passed, failed, or did not complete the course. Appendix A shows the coursetaking question as it appeared in the 2009 NAEP twelfth-grade mathematics assessment, while appendix B shows the coursetaking question that appeared in the 2009 NAEP twelfth-grade science assessment student questionnaire.

Two important pieces of information are collected by the coursetaking questions. The first is what courses the students have taken, which indicate the subject matter they have learned. To do well on the NAEP assessments, the students must understand and show proficiency in content across high school courses within the assessment subject. For example, the 2009 NAEP twelfth-grade mathematics assessment focused on algebra, geometry, data analysis, and probability (National Assessment Governing Board 2012), and the 2009

NAEP twelfth-grade science assessment focused on life and physical science (National Assessment Governing Board 2014). Information on the courses students took can indicate how well they may perform on the NAEP assessments.

The second piece of information collected from the student coursetaking questionnaire is the grade in which a high school course was taken. When a high school student takes a course can affect their performance on the NAEP twelfth-grade assessment. For example, students who took algebra I in or before ninth grade did better on the 2015 NAEP twelfth-grade mathematics assessment than students who took algebra I in tenth, eleventh, or twelfth grades (U.S. Department of Education 2016). In addition, information on when a student took a course is important to research on high school course sequences, which looks at the order in which courses are taken while in high school.

The student transcript data collected as part of the NAEP HSTS indicate what courses the students took in high school between the ninth and twelfth grades. The transcripts were collected for all high school graduates from schools that participated in the associated NAEP twelfth-grade assessments. Course information found on the transcripts included course names, grades the courses were taken, credits earned, and letter or numeric grades awarded. The transcripts listed all courses that students took in high school, regardless of whether students passed, failed, audited, withdrew, or did not complete the courses. Each course listed on a transcript was assigned a Classification of Secondary School Courses (CSCC) code based on the course title and the description of the course content found in the school's course catalog. Using the assigned CSCC course codes, student coursetaking information such as credits earned by course subject, grade point averages, and highest-level courses reached were derived from the transcripts.

## Methodology

Matching the mathematics and science courses that the students reported taking on the NAEP student questionnaires to the mathematics and science courses recorded on their transcripts provides a measure of validity of the student self-reported coursework. Because high school transcripts also indicate the grade in which the course was taken, the students' responses to the most recent grade level in which a course was taken can also be verified.

To compare student-reported and transcript-recorded courses, the CSSC codes assigned to the mathematics and science courses recorded on the students' high school transcripts were matched with the mathematics and science categories listed on the NAEP student questionnaire. The CSSC coding system has 91 mathematics and 149 science course codes, while the NAEP coursetaking questions had 13 mathematics and 12 science course categories. For this study, CSSC codes were assigned to the mathematics and science course categories reported in the NAEP twelfth-grade mathematics and science student questionnaires. With the assignments, comparisons could be made between a student's responses to the coursework questions and the courses recorded on the student's transcript. Additional discussion about how the comparison was created, including appendixes that show how the CSSC codes were assigned to the NAEP course categories, can be found in the Technical Notes.

The first results section of this report, Comparing Student-Reported and Transcript-Recorded Mathematics Courses, and the second results section, Comparing Student-Reported and Transcript-Recorded Science Courses, present analyses that show the differences between individual student-reported and transcript-recorded mathematics and science courses, respectively. The differences are found when

comparing the mathematics and science courses students reported they took with the mathematics and science courses recorded on their transcripts. The differences examined are threefold:

- ♦ instances where students reported taking courses not recorded on their transcripts,
- ♦ instances where students did not report courses recorded on their transcripts; and
- ♦ instances where students incorrectly reported the most recent grades in which courses were taken.

As the transcripts collected during the NAEP HSTS are considered the students' official records of high school coursework, the mathematics and science courses recorded on the transcripts were assumed to be correct. There are limitations with this assumption, which are discussed in more detail in the Technical Notes, but the established quality control procedures used by NAEP HSTS to minimize transcript coding errors minimizes these limitations.

The final report section, Analyzing Student-Reported and Transcript-Recorded Coursework, shows how the differences between student-reported and transcript-recorded courses affects how student coursetaking measures are generated and analyzed. Coursework measures such as the highest-level course taken, which involve examining multiple years of coursework, are calculated using both the student-reported and transcript-recorded courses. The two sets of measures are then compared to determine if there are any statistically significant differences and how those differences affect reporting student coursetaking data when using student-reported courses. Comparing the NAEP twelfth-grade mathematics and science assessment scores with the student coursework measures determines if there are differences in the scores between student-reported courses and transcript-recorded courses.



## Analysis Notes

Findings in this report are the result of analyzing samples of students who participated in both the NAEP twelfth-grade assessments and HSTS in 2000, 2005, or 2009. The figures in the main body of the report show the 2009 data, while the tables show comparisons between the 2009 data and the previous HSTS data. Appendixes E and F contain the full data tables, including standard errors, for all figures and tables presented in the report.

To be included in the student samples for this study, the student must have graduated high school with a regular or honors diploma, taken either the NAEP mathematics or science assessment, and had a complete transcript collected as part of the HSTS. A complete transcript refers to a transcript that contained courses for each grade from ninth grade to twelfth grade. The HSTS data are weighted so that findings represent the national high school graduate populations for those years; for this report, graduates are referred to as “students” when discussing the results. For more details about the sample, refer to the Technical Notes.

The course names that appear in the tables and figures in this report are the course titles listed on the NAEP student questionnaires. Appendixes A and B show the coursetaking questions as they appeared on the 2009 NAEP student questionnaires. Appendixes C and D show how

CSSC codes for mathematics and science courses were mapped to the mathematics and science course categories that appear on the student questionnaires. For more information on how the CSSC codes were mapped, see the Technical Notes.

NCES uses widely accepted statistical standards in analyzing data. When comparing two estimates to determine if they are different, statistical *t* tests were performed that considered both the magnitude of the difference between the estimates and standard errors of those estimates. No adjustments were made for multiple comparisons. Differences were considered significant at the .05 alpha level. Unless otherwise noted, this report only discusses findings that are significant. The asterisk symbol (\*) is used in tables and figures to indicate significant differences.

This study seeks to determine the validity of high school students’ self-reported mathematics and science coursetaking on the NAEP twelfth-grade mathematics and science assessments by comparing their responses to their student transcripts collected through the NAEP HSTS. However, the study was not designed to identify the reasons why student self-reported coursework may differ from transcript information. All results in this report are estimates based on samples of students and are therefore subject to sampling and measurement errors. More information about interpreting statistical significance can be found in the Technical Notes.



# Comparing Student-Reported and Transcript-Recorded Mathematics Courses

The coursetaking questions listed in the NAEP twelfth-grade mathematics and science assessment student questionnaires have two components: what mathematics or science courses the student took, and the most recent grade in which the student took the course. The students' high school transcripts, which are their official high school coursework records, also contain this information. Matching the student self-reports to their transcripts indicates how accurately the student recalls what courses they took and when they took them.

Comparison of the student-reported information on the NAEP student questionnaires with students' transcripts reveals three types of discrepancies. First, students report taking courses that are not recorded on their transcripts. Second, students did not report courses that are recorded on their transcripts. Third, students report taking a course in a different grade than is recorded on the transcript. This section of the report presents analyses addressing these three types of discrepancies for mathematics courses.

The section begins with a comparison of the percentages of students taking mathematics courses based on student-reported and transcript-recorded information. This comparison provides an overall indicator of the extent to which students either overreport or underreport their mathematics coursetaking.

The second analysis shows the percentage distribution of high school students by their student-reported and transcript-recorded mathematics courses. It addresses both the extent to which students report courses not recorded on transcripts and that they fail to report courses recorded on transcripts. This analysis presents the percentage distribution of students who (a)

correctly reported taking courses found on their transcripts, (b) reported taking courses not found on their transcripts, (c) failed to report courses found on their transcripts, and (d) correctly did not report courses that were not found on their transcripts.

The next analysis presents the percentage of student-reported mathematics courses that were also recorded on students' transcripts. This analysis is a measure of the extent to which students report courses and their transcripts indicate that they did not take the course.

The fourth analysis presents the percentage of students' transcripts where the recorded mathematics courses were also reported by the students. This analysis is a measure of the extent to which transcripts record courses that students fail to report.

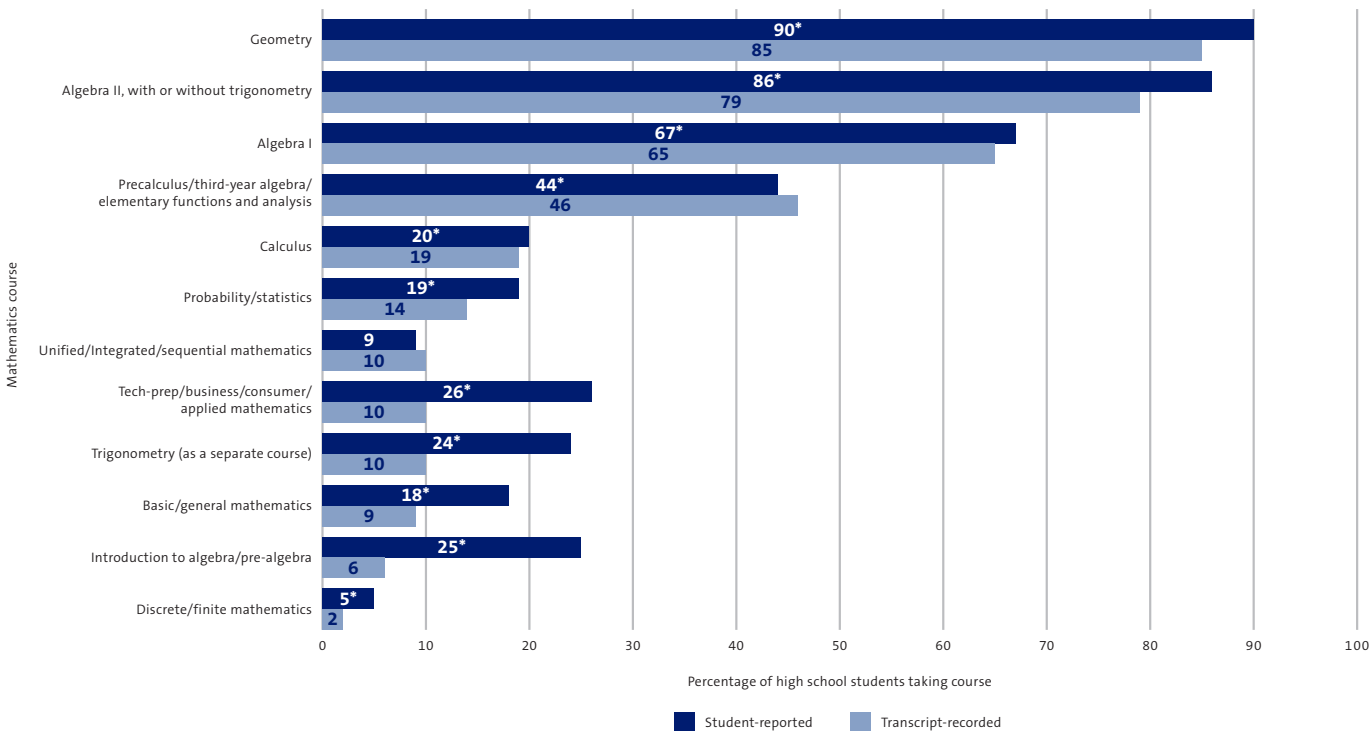
The fifth analysis addresses the extent to which students misreport the most recent grade level in which they take mathematics courses. This analysis is reported as the percentage of students whose self-reports and transcript records match on the grade level in which the course was most recently taken.

Finally, the section closes with an overall analysis of the frequency of discrepancies. This analysis is reported as the percentage distribution of students by the number of discrepancies found between their self-reported mathematics course information and their transcript records.

All of the analyses are provided in detail for 2009, and in less detail for 2005 and 2000—the two previous High School Transcript Study collections. The highlighted findings in the blue call-out boxes summarize the overall pattern of results. They are not intended to show every meaningful result shown in a table or figure.

For most mathematics courses, a higher percentage of students reported taking the course than was recorded on their transcripts.

**FIGURE 1.** Comparison of student-reported and transcript-recorded percentages of high school students taking mathematics courses: 2009



\* Significantly different ( $p < .05$ ) from transcript-recorded value.  
NOTE: The “Other mathematics course” category is NOT shown.  
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 1** compares the percentages of high school students in 2009 who reported taking each mathematics course to the percentage of students with the course recorded on their transcripts. For all mathematics courses except precalculus and

unified/integrated mathematics, the percentage of students who reported taking the course was higher than the percentage of students whose transcripts recorded the course. The difference between self-reported and transcript-recorded

Similar to 2009, higher percentages of students reported taking geometry, algebra II, and calculus courses in 2000 and 2005 than were recorded on their transcripts.

**TABLE 1.** Comparison of student-reported and transcript-recorded percentages of high school students taking mathematics courses: 2000, 2005, and 2009

Mathematics course	Percentage of high school graduates taking mathematics course					
	2000		2005		2009	
	Student-reported	Transcript-recorded	Student-reported	Transcript-recorded	Student-reported	Transcript-recorded
Basic/general mathematics	11	15*	19	11*	18	9*
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	25	12*	26	10*	26	10*
Introduction to algebra/pre-algebra	30	11*	30	9*	25	6*
Algebra I	70	70	70	69	67	65*
Geometry	87	81*	89	84*	90	85*
Algebra II, with or without trigonometry	82	75*	82	74*	86	79*
Trigonometry (as a separate course)	27	10*	24	9*	24	10*
Pre-calculus/third-year algebra/elementary functions and analysis	40	35*	39	38	44	46*
Unified/integrated/sequential mathematics	10	11	9	15*	9	10
Probability/statistics	17	7*	16	9*	19	14*
Calculus	18	16*	19	17*	20	19*
Discrete/finite mathematics	4	1*	4	2*	5	2*

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

\* Significantly different ( $p < .05$ ) from student-reported percentage.

NOTE: The "Other mathematics courses" category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

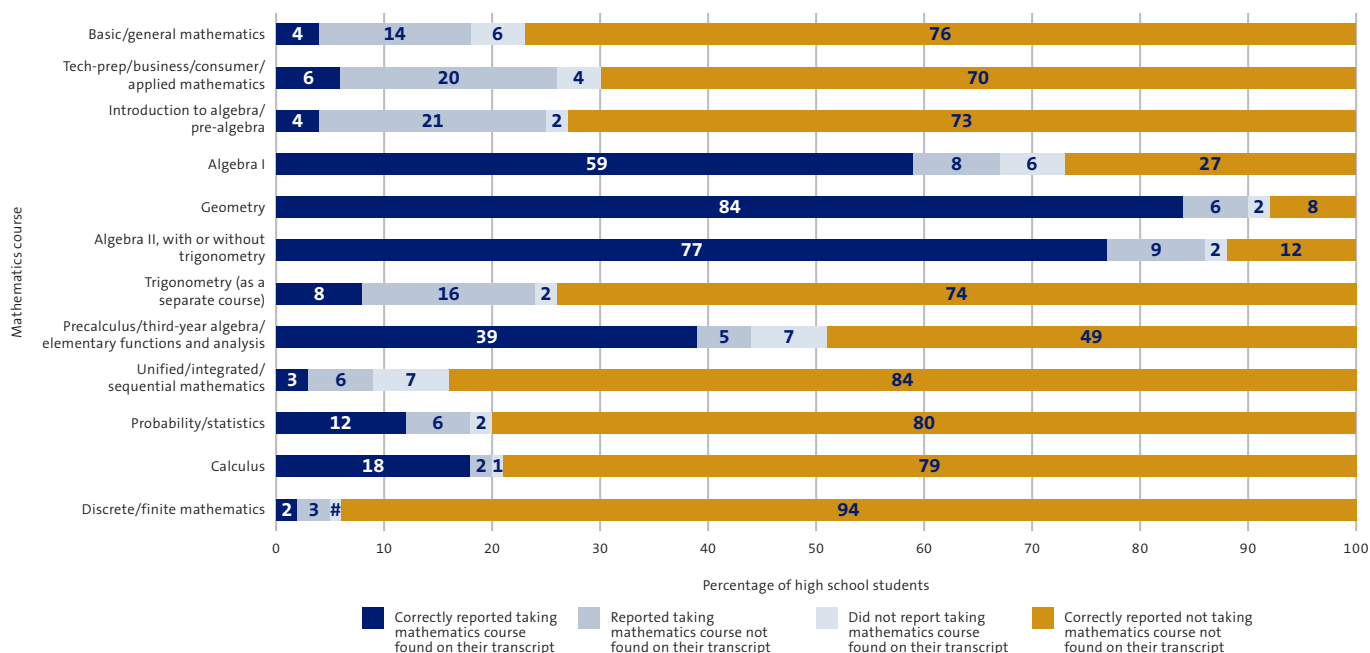
data ranged from about 1.5 percentage points (calculus) to almost 20 percentage points (pre-algebra). Precalculus courses were the only mathematics courses underreported by students as compared to their transcripts.

**Table 1** compares the percentages of high school students who reported taking mathematics courses in 2000, 2005, and 2009 with the percentages of mathematics courses taken reported on their high school transcripts. Of the 12 mathematics courses listed in the table, there were eight courses—including pre-algebra, geometry,

algebra II, trigonometry, probability/statistics, and calculus—where a higher percentage of students reported taking the course than was recorded on their transcripts for all three HSTS years. A statistically significant gap between student-reported and transcript-recorded percentages of students taking algebra I was found in 2009, but not in either 2000 or 2005. A higher percentage of students in 2000 reported taking precalculus than was recorded on their transcripts; by 2009, the percentage of students reported taking the course was lower than was recorded on their transcripts.

For each mathematics course, the match rate between students and transcripts was at least 75 percent.

**FIGURE 2.** Percentage distribution of high school students by their self-reported and transcript-recorded mathematics coursetaking: 2009



# Rounds to zero.

NOTE: Details may not sum to total because of rounding. The “Other mathematics course” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

Figure 2 shows the percentage distribution of high school students in 2009 taking mathematics courses, based on the combination of their self-reported and transcript-recorded responses. It presents a summary of the extent to which students reported mathematics courses that were not recorded on their transcripts, failed to report courses that were recorded on their transcripts, and when student self-reports and transcripts agreed either that the course was taken or not taken. A “match rate” can be calculated by adding together the percentage of transcripts for which students correctly reported taking a course recorded on their transcript and the percentage for which students correctly reported not taking a course not recorded on their transcript. Using this measure, the match

rate between student-reported and transcript-recorded mathematics courses in 2009 ranged from 76 percent (tech-prep/applied mathematics) to 97 percent (calculus).

However, only for three most common mathematics courses taken—algebra I, geometry, and algebra II—does the match rate derive mostly from students correctly reporting taking the courses recorded on their transcripts. In other cases, the high match rates reflect mostly agreement between the transcript and student reports of not taking a course. There were two mathematics courses in 2009—basic/general mathematics and unified/integrated mathematics—where the percentage of students not reporting a course found on their transcripts was larger than the percentage of students

Both geometry and algebra II courses saw increases in the percentages of high school students who correctly reported those courses found on their transcripts.

**TABLE 2.** Percentage distribution of high school students by their self-reported and transcript-recorded mathematics coursetaking: 2000, 2005, and 2009

Mathematics course	Percentage of high school graduates who											
	Correctly reported taking mathematics course found on their transcripts			Reported taking mathematics course not found on their transcripts			Did not report taking mathematics course found on their transcripts			Correctly reported not taking mathematics course not found on their transcripts		
	2000	2005	2009	2000	2005	2009	2000	2005	2009	2000	2005	2009
Basic/general mathematics	5	5*	4	6*	15	14	11*	6	6	78	74*	76
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	9*	6	6	16*	20	20	4	4	4	72	70	70
Introduction to algebra/pre-algebra	10*	7*	4	21	23	21	2	2	2	68*	68*	73
Algebra I	61	62*	59	9	8	8	9*	7*	6	20*	23*	27
Geometry	79*	83	84	8	6	6	2	2	2	11*	9	8
Algebra II, with or without trigonometry	72*	72*	77	10	10	9	3	2	2	15*	16*	12
Trigonometry (as a separate course)	9	8	8	18	16	16	1	1*	2	72	75	74
Pre-calculus/third-year algebra/elementary functions and analysis	31*	32*	39	10*	7*	5	4*	6	7	56*	55*	49
Unified/integrated/sequential mathematics	5	5	3	5	5*	6	6	11*	7	84	80*	84
Probability/statistics	6*	8*	12	11*	7*	6	#*	#*	2	83*	84*	80
Calculus	15*	16	18	3	3	2	1	1	1	81	80	79
Discrete/finite mathematics	1*	1	2	4	3	3	#*	#	#	96*	96*	94

# Rounds to zero.

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: Details may not sum to total because of rounding. The “Other mathematics course” category is not shown.

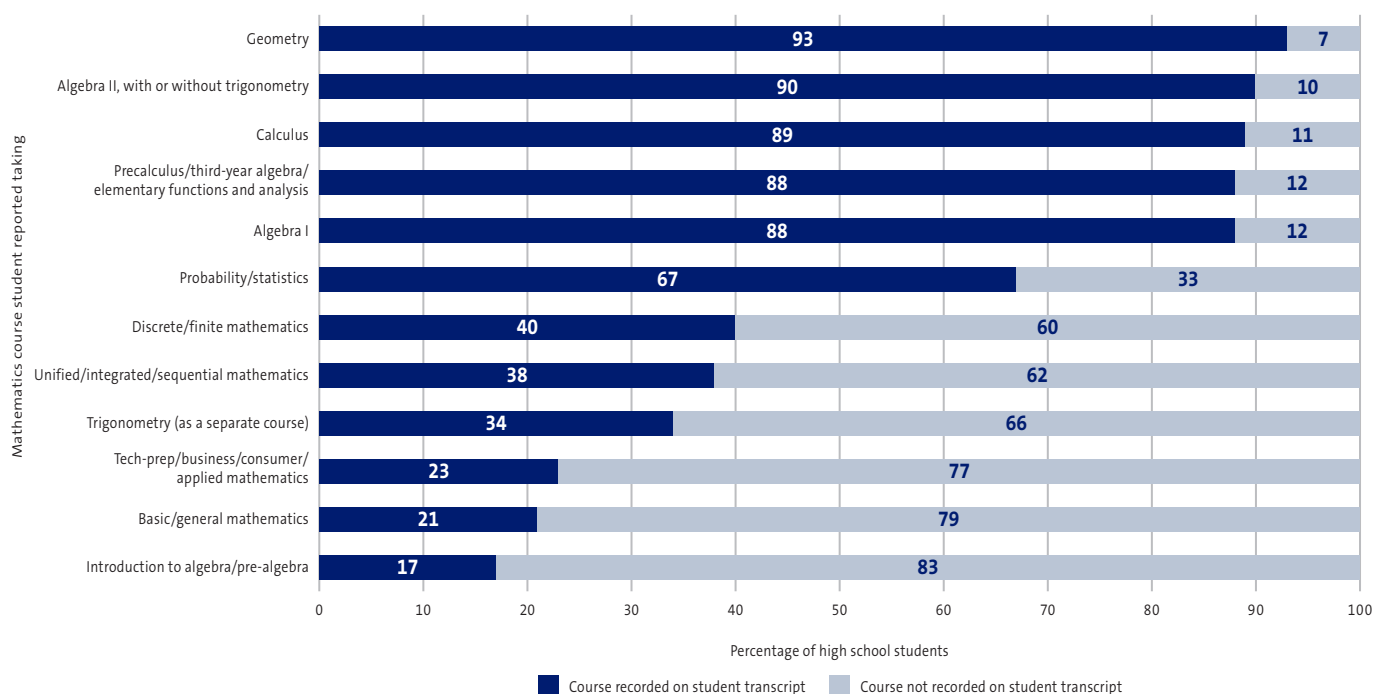
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

reporting a course found on their transcripts. There were also six mathematics courses—basic/general mathematics, tech-prep/applied mathematics, pre-algebra, trigonometry, unified/integrated mathematics, and discrete/finite mathematics—where the percentage of students reporting a course not found on their transcripts was larger than the percentage of students reporting a course found on their transcripts. Figures 3 and 4 focus on these mathematics course reporting errors.

**Table 2** shows the percentage distribution of high school students’ mathematics coursetaking in 2000, 2005, and 2009, based on comparisons between student-reported and transcript-recorded data. From 2000 to 2009, the percentage of students who correctly reported taking a mathematics course found on their transcripts rose for geometry, algebra II, precalculus, probability/statistics, calculus, and discrete/finite mathematics, but fell for tech-prep/applied mathematics and pre-algebra courses.

About 90 percent of algebra I, geometry, and algebra II courses reported by high school students were found on their transcripts.

**FIGURE 3.** Percentage of high school students who reported taking mathematics courses that were recorded on their transcripts: 2009



NOTE: Details may not sum to total because of rounding. The “Other mathematics course” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

The percentage of students who reported taking tech-prep/applied mathematics courses not found on their transcripts increased from 2000 to 2009, as did the percentages of students who did not report taking precalculus, probability/statistics, and discrete/finite mathematics courses found on their transcripts.

**Figure 3** shows the percentages of high school students who reported taking mathematics courses that had the courses recorded on their high school transcripts. This figure focuses on the mathematics courses students reported they took.

Of the four most common high school mathematics courses reported by students on the 2009 NAEP twelfth-grade mathematics assessment student questionnaire—algebra I, geometry, algebra II, and precalculus—at least 88 percent of the students’ transcripts recorded those courses. Of the three next most common mathematics courses reported by students—tech-prep/applied mathematics, pre-algebra, and trigonometry—between 17 percent and 34 percent of students who reported having taken those courses had those courses recorded on their transcripts. For unified/integrated mathematics courses, only 38 percent of the students who reported taking the course had the course recorded on their transcripts.

Higher percentages of precalculus and calculus courses that high school students reported taking were recorded on students' transcripts in 2009 than in 2000.

**TABLE 3.** Percentage of high school students who reported taking mathematics courses that were recorded on their transcripts: 2000, 2005, and 2009

Mathematics course student reported taking	2000	2005	2009
Basic/general mathematics	43*	24	21
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	36*	24	23
Introduction to algebra/pre-algebra	32*	24*	17
Algebra I	87	89	88
Geometry	90	93	93
Algebra II, with or without trigonometry	88	88	90
Trigonometry (as a separate course)	34	35	34
Pre-calculus/third-year algebra/elementary functions and analysis	76*	82*	88
Unified/integrated/sequential mathematics	50	50*	38
Probability/statistics	37*	53*	67
Calculus	83*	86*	89
Discrete/finite mathematics	17*	32	40

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: The "Other mathematics course" category is not shown.

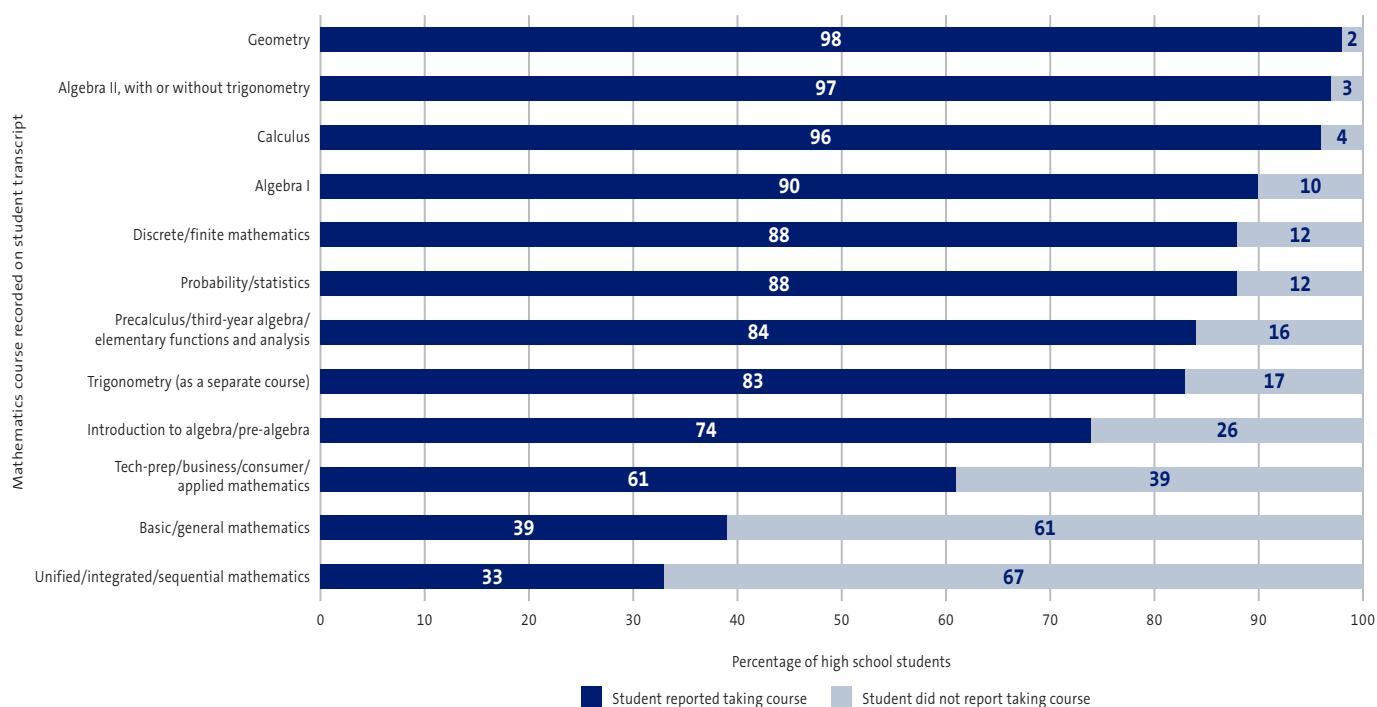
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**Table 3** shows the percentage of high school students in 2000, 2005, and 2009 who reported taking mathematics courses that were recorded on their transcripts. Similar to figure 3, this table focuses on the mathematics courses students reported they took. From 2000 to 2009, there were four mathematics courses—precalculus, probability/statistics, calculus, and discrete/finite mathematics—that showed an increase in the percentage of student-reported courses that

were also recorded on the high school transcripts. The increases ranged from 5.5 percentage points (calculus) to about 30 percentage points (probability/statistics). There were three mathematics courses that showed a decrease in the percentage of student-reported courses that were also recorded on their transcripts—basic/general mathematics (22 percentage points), tech-prep/applied mathematics (12 percentage points), and pre-algebra (15 percentage points).

Students reported at least 90 percent of the algebra I, geometry, and algebra II courses recorded on their high school transcripts.

**FIGURE 4.** Percentage of high school students' transcripts where the recorded mathematics courses were reported by students: 2009



NOTE: Details may not sum to total because of rounding. The "Other mathematics course" category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 4** shows the percentage of high school students' transcripts where the mathematics courses recorded on their transcripts were reported by the students on the NAEP twelfth-grade mathematics assessment student questionnaire. Unlike the previous figure, which looks at the mathematics courses students reported they took, this figure focuses on the mathematics courses found on the students' transcripts.

The three most common mathematics courses appearing on high school students' transcripts in 2009 were algebra I, geometry, and algebra II. For each of these three courses, among the

students whose transcripts listed the course, at least 90 percent reported taking the course. The three next most common courses appearing on high school transcripts were precalculus, calculus, and probability/statistics. For each of these three courses, among the students whose transcripts listed the course, between 84 percent and 96 percent reported taking the course. For unified/integrated mathematics courses, which appeared on about 10 percent of high school students' transcripts in 2009, only about one-third of the students whose transcripts listed that course reported taking the course.



Higher percentages of algebra I and II courses recorded on high school students' transcripts were reported by students in 2009 than in 2000.

**TABLE 4.** Percentage of high school students' transcripts where the recorded mathematics courses were reported by students: 2000, 2005, and 2009

Mathematics course recorded on student transcript	2000	2005	2009
Basic/general mathematics	31*	42	39
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	72*	62	61
Introduction to algebra/pre-algebra	84*	80*	74
Algebra I	87*	90	90
Geometry	98	98	98
Algebra II, with or without trigonometry	96*	97	97
Trigonometry (as a separate course)	92	92*	83
Pre-calculus/third-year algebra/elementary functions and analysis	88	84	84
Unified/integrated/sequential mathematics	42	30	33
Probability/statistics	96*	95*	88
Calculus	95	97	96
Discrete/finite mathematics	100*	79	88

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: The "Other mathematics course" category is not shown.

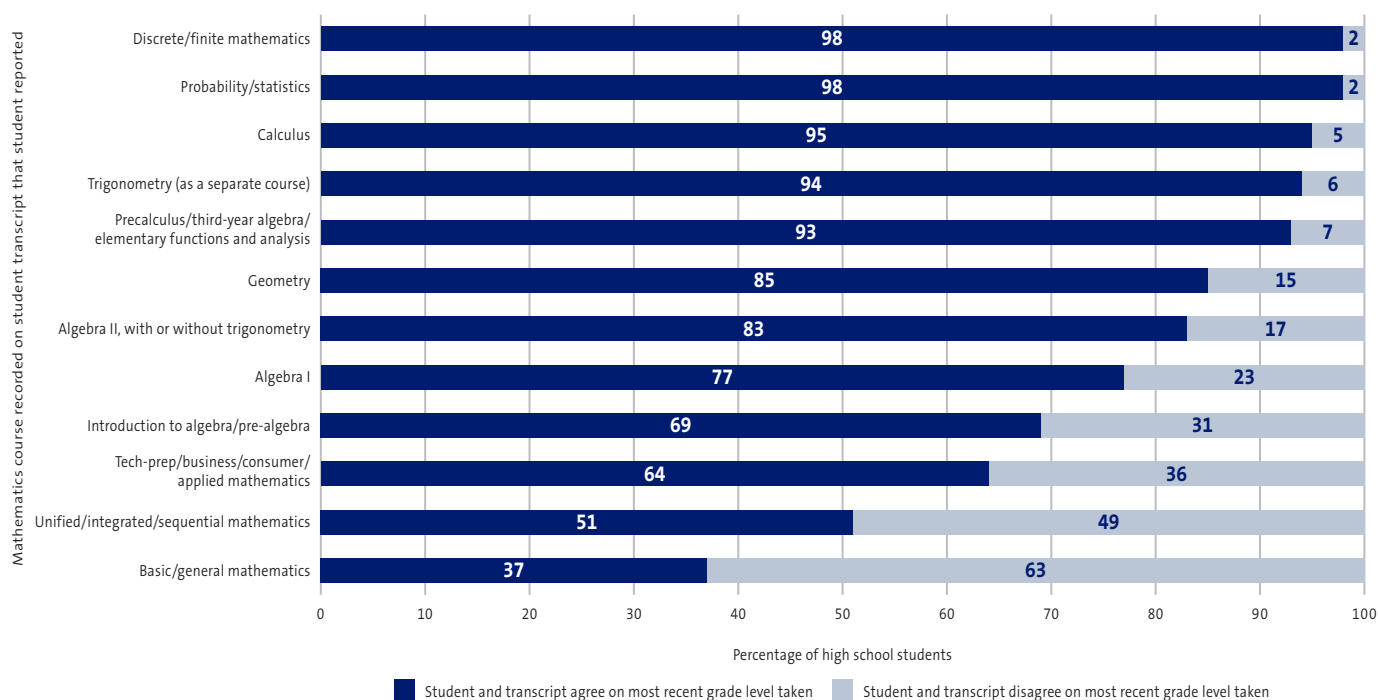
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**Table 4** shows the percentage of high school students' transcripts in 2000, 2005, and 2009 where the recorded mathematics courses were also reported by students. Compared to earlier years, high school students more often reported the algebra I and algebra II courses recorded on their high school transcripts, with an increase of nearly 4 percentage points for reporting algebra I courses from 2000 to 2009. However, the percentage of high school students reporting the probability/statistics courses recorded found on their transcripts dropped about 8 percentage points over the same period.

For the NAEP twelfth-grade mathematics assessment, high school students are asked to report on mathematics coursetaking across their high school years, including the most recent grade level the courses were taken. Because when high school students take mathematics courses is a major factor in determining their performance on the NAEP twelfth-grade mathematics assessment, it is important to determine how accurately students reported the grade level they took mathematics courses. Based on the high school students' transcripts in 2009 where the recorded mathematics courses were reported by

## High school students best recalled the most recent grade level of mathematics courses traditionally taken after algebra II.

**FIGURE 5.** Percentage of high school students' transcripts where the recorded mathematics courses were reported by students, by the reported most recent grade level taken: 2009



NOTE: Details may not sum to total because of rounding. The “Other mathematics course” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

the students, **figure 5** shows the percentages of those transcripts where the most recent grade level recorded on the transcript matches the most recent grade level reported by the student.

There are five mathematics courses where at least 90 percent of students correctly reported the most recent grade level taken as found on their transcripts, ranging from 93 percent for precalculus courses to 98 percent for both probability/statistics

and discrete/finite mathematics courses. These five mathematics courses are generally taken after a student completes algebra II, most often during the eleventh and twelfth grades. For courses generally taken before algebra I, which most students usually take before entering high school, 69 percent of students correctly reported the most recent grade level they took pre-algebra, while 37 percent correctly reported the most recent grade level they took basic/general mathematics.

The match rate on the most recent grade level taken between student reports and transcripts decreased from 2000 to 2009 for three mathematics courses.

**TABLE 5.** Percentage of high school students' transcripts where the recorded mathematics courses were reported by students and agreed on the most recent grade level taken: 2000, 2005, and 2009

Mathematics course recorded on student transcript and reported by student with the same most recent grade level taken	2000	2005	2009
Basic/general mathematics	38	38	37
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	68	62	64
Introduction to algebra/pre-algebra	77*	70	69
Algebra I	79	78	77
Geometry	88*	85	85
Algebra II, with or without trigonometry	81	84	83
Trigonometry (as a separate course)	95	96	94
Pre-calculus/third-year algebra/elementary functions and analysis	93	93	93
Unified/integrated/sequential mathematics	59	58	51
Probability/statistics	99*	98	98
Calculus	96	97	95
Discrete/finite mathematics	95	98	98

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: The "Other mathematics course" category is not shown.

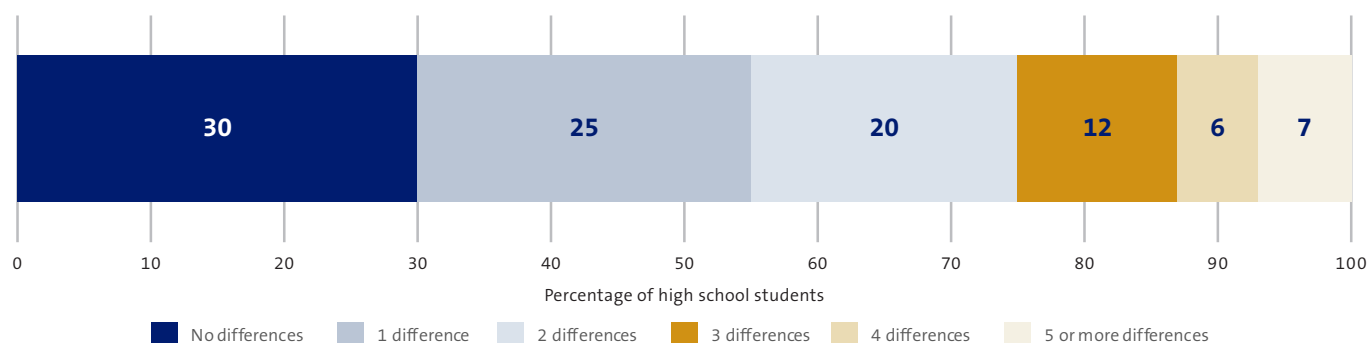
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

Based on the high school students' transcripts in 2000, 2005, and 2009 where the recorded mathematics courses were reported by the students, **table 5** shows the percentages of those transcripts where the students and transcripts agreed on the most recent grade level the courses were taken. Between 2000 and 2009, the

percentage of students who correctly reported the most recent grade level taken of mathematics courses listed on their transcripts decreased for three mathematics courses—about 1 percentage point for probability/statistics courses, 4 percentage points for geometry courses, and 8 percentage points for pre-algebra courses.

About 55 percent of students reported their mathematics courses correctly or only had one difference with their transcript records.

**FIGURE 6.** Percentage distribution of overall number of differences between student-reported and transcript-recorded mathematics courses taken: 2009



NOTE: Details may not sum to total because of rounding. A difference between student-reported and transcript-recorded courses occurs when a student either reports a mathematics course not recorded on his or her transcript or does not report taking a mathematics course recorded on his or her transcript. Five or more differences between student-reported and transcript-recorded courses were collapsed into a single category primarily for graphical display purposes.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 6** shows the percentage of high school students in 2009 broken down by the number of differences found between the mathematics courses they reported on the NAEP student questionnaire and the mathematics courses recorded on their transcripts. A difference occurred when a student either reported taking a course that was not recorded on his or her transcript or did not report a course that was recorded on the transcript. The analyses presented in this figure

focus only on the courses and do not look at the most recent grade level a course was taken.

In 2009, about 55 percent of high school students who reported mathematics courses either exactly matched the transcript-recorded mathematics courses or only had one difference. Approximately 20 percent of the students had two differences between what they reported and their transcripts recorded, while about 25 percent had three or more differences.

A higher percentage of high school students in 2000 accurately reported the mathematics courses found on their transcripts than in 2009.

**TABLE 6.** Percentage distribution of overall number of differences between student-reported and transcript-recorded mathematics courses taken: 2000, 2005, and 2009

Number of differences	2000	2005	2009
0	34*	28	30
1	25	25	25
2	19	22*	20
3	10*	13	12
4	5*	6	6
5 or more	6	7	7

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: A difference between student-reported and transcript-recorded courses occurs when a student either reports a course not recorded on his or her transcript or did not report taking a course recorded on his or her transcript. Details may not sum to total because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**Table 6** shows the percentage distribution of high school students in 2000, 2005, and 2009 by the number of differences found between their self-reported and transcript-recorded mathematics courses. Compared to 2000, there was a 4 percentage point decrease in the

percentage of high school students in 2009 whose reported mathematics courses exactly matched what was recorded on their transcripts. However, a consistent one-fourth of students had only one difference in reporting in 2000, 2005, and 2009.

# Comparing Student-Reported and Transcript-Recorded Science Courses

As with the mathematics courses presented in the previous section, comparison of the student-reported science courses on the NAEP student questionnaires with students' transcripts reveals three types of discrepancies. First, students report taking courses that are not recorded on their transcripts. Second, students did not report courses that are recorded on their transcripts. Third, students report taking a course in a different grade than is recorded on the transcript. This section of the report presents analyses addressing these three types of discrepancies for science courses.

The section begins with a comparison of the percentages of students taking science courses based on student-reported and transcript-recorded information. This comparison provides an overall indicator of the extent to which students either overreport or underreport their science coursetaking.

The second analysis shows the percentage distribution of high school students by their student-reported and transcript-recorded science courses. It addresses both the extent to which students report courses not recorded on transcripts and that they fail to report courses recorded on transcripts. This analysis presents the percentage distribution of students who (a) correctly reported taking courses found on their transcript, (b) reported taking courses not found on their transcript, (c) failed to report courses found on their transcript, and (d) correctly did not report courses that were not found on their transcripts.

The next analysis presents the percentage of student-reported science courses that were also recorded on students' transcripts. This analysis is a measure of the extent to which students report

courses and their transcripts indicate that they did not take the course.

The fourth analysis presents the percentage of students' transcripts where the recorded science courses were also reported by the students. This analysis is a measure of the extent to which transcripts record courses that students fail to report.

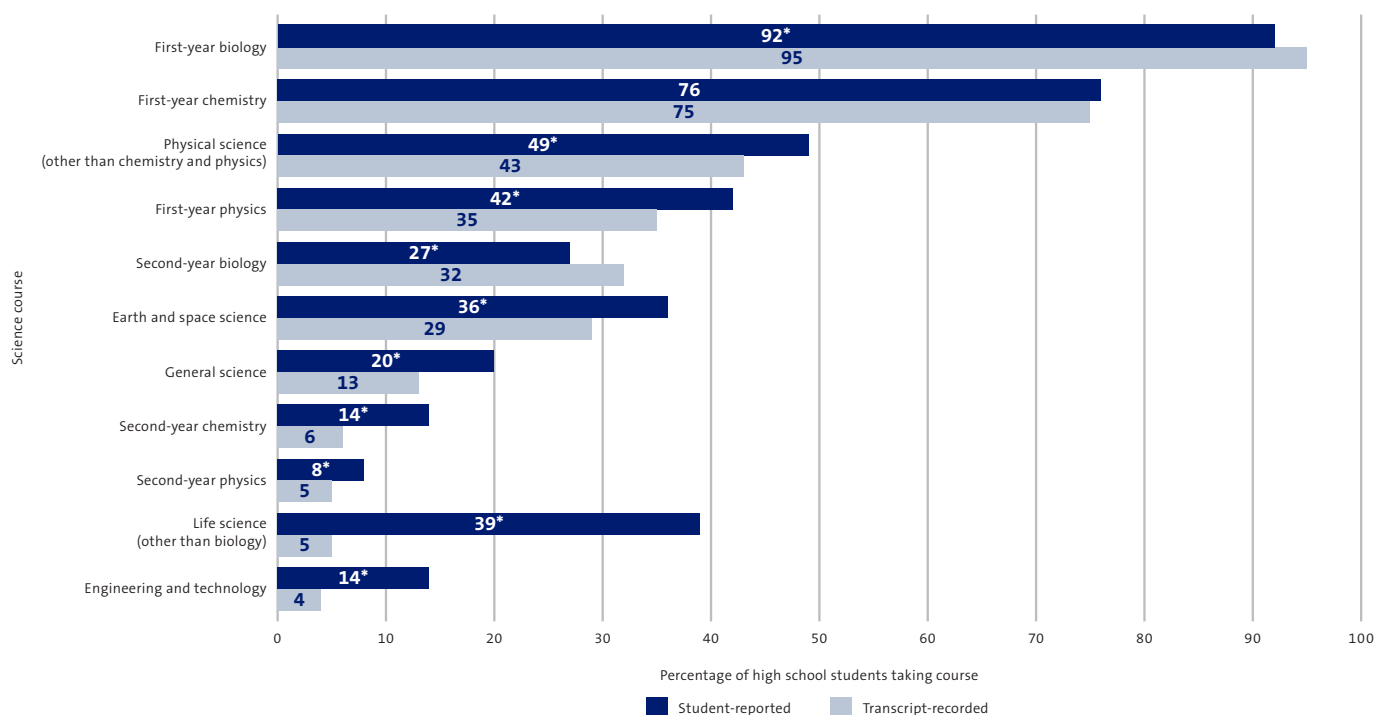
The fifth analysis addresses the extent to which students misreport the most recent grade level in which they take science courses. This analysis is reported as the percentage of students' transcripts where student reports and transcript records match on the grade level in which the course was most recently taken.

Finally, the section closes with an overall analysis of the frequency of discrepancies. This analysis is reported as the percentage distribution of students by the number of discrepancies found between their self-reported science course information and their transcript records.

All of the analyses are provided in detail for 2009, and in less detail for 2005 and 2000—the two previous High School Transcript Study collections.

For most science courses, a higher percentage of students reported taking the course than was recorded on their transcripts.

**FIGURE 7.** Comparison of student-reported and transcript-recorded percentages of high school students taking science courses: 2009



\* Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: The "Other science course" category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 7** compares the percentages of high school students in 2009 who reported taking each science course to the percentage of students with the course recorded on their transcripts. For 8 of the 11 science courses, the percentage of students who reported taking the course was higher than the percentage of students whose transcripts

recorded the course. The differences ranged from 2 percentage points (second-year physics) to almost 34 percentage points (life science). For both first- and second-year biology courses, the percentage of students who reported the course was smaller than the percentage of students whose transcripts recorded the course.

Similar to 2009, higher percentages of students reported taking second-year chemistry and first-year physics courses in 2000 and 2005 than were recorded on their transcripts.

**TABLE 7.** Comparison of student-reported and transcript-recorded percentages of high school students taking science courses: 2000, 2005, and 2009

Science course	Percentage of high school students taking science course					
	2000		2005		2009	
	Student-reported	Transcript-recorded	Student-reported	Transcript-recorded	Student-reported	Transcript-recorded
Earth and space science	29	21*	36	27*	36	29*
Life science (other than biology)	33	3*	40	4*	39	5*
Physical science (other than chemistry and physics)	54	49*	49	43*	49	43*
General science <sup>1</sup>	24	14*	31	17*	20	13*
First-year biology	91	93*	91	92	92	95*
Second-year biology	28	31*	27	31*	27	32*
First-year chemistry	71	69*	74	70*	76	75
Second-year chemistry	13	8*	15	10*	14	6*
First-year physics	36	33*	37	31*	42	35*
Second-year physics	6	4*	6	6	8	5*
Science and technology/ Engineering and technology <sup>2</sup>	12	1*	13	2*	14	4*

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as “Science and technology” in 2000 and 2005 and as “Engineering and technology” in 2009. Considered similar categories for trend purposes.

\* Significantly different ( $p < .05$ ) from student-reported percentage.

NOTE: The “Other science courses” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

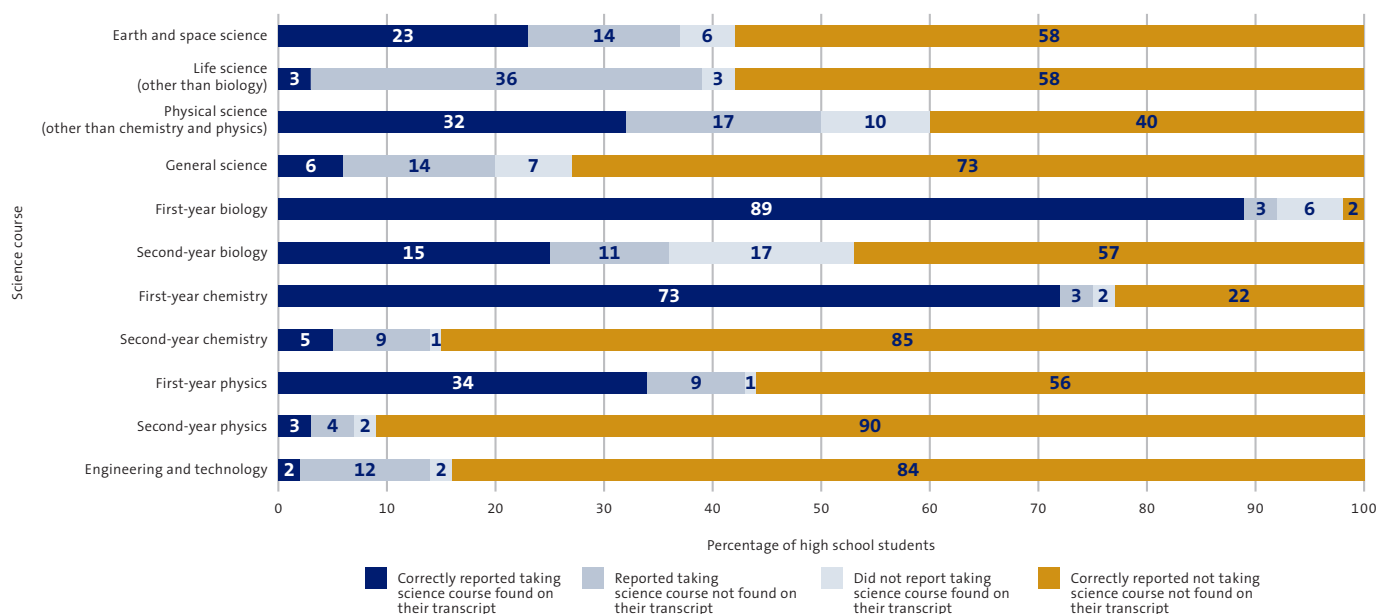
**Table 7** compares the percentages of high school students who reported taking mathematics courses in 2000, 2005, and 2009 with the percentages of mathematics courses taken reported on their high school transcripts. Of the 11 science courses, there are seven science courses—including earth and space science, life science, physical science, second-year chemistry,

and first-year physics courses—where higher percentages of students reported taking the courses than was recorded on their transcripts for all three HSTS years. Second-year biology was the only science course where a higher percentage of transcripts recorded the course than students reported for all three HSTS years.



With the exception of life science, the match rate between students and transcripts for science courses was at least 72 percent.

**FIGURE 8.** Percentage distribution of high school students by their self-reported and transcript-recorded science coursetaking: 2009



NOTE: Details may not sum to total because of rounding. The “Other science course” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 8** shows the percentage distribution of high school students in 2009 taking science courses, based on the combination of their self-reported and transcript-recorded responses. It presents a summary of the extent to which students reported science courses that were not found on their transcripts, failed to report courses that were found on their transcripts, and when student reports and transcript records agreed either that the course was taken or not taken. In 2009, the match rate between student-reported and transcript-recorded science courses, which is calculated by adding together the percentage of transcripts for which students correctly reported taking a science course found on their transcript and the percentage for which students correctly reported not taking a science course not found

on their transcript, ranged from 61 percent (life science) to 94 percent (first-year chemistry).

Only for two most common science courses taken—first-year biology and chemistry—does the match rate derive mostly from students reporting taking the courses found on their transcripts. For most other science courses, the high match rates reflect mostly agreement between the transcript and students that the student did not take a course. There were five science courses in 2009—life science, general science, second-year chemistry, second-year physics, and engineering/technology—where the percentage of students reporting a course not found on their transcripts was larger than the percentage of students reporting a course found on their transcripts. Most

Both earth and space science and first-year chemistry courses saw increases in the percentage of high school students who correctly reported those courses found on their transcripts.

**TABLE 8.** Percentage distribution of high school students by their self-reported and transcript-recorded science coursetaking: 2000, 2005, and 2009

Science course	Percentage of high school graduates who											
	Correctly reported taking science course found on their transcripts			Reported taking science course not found on their transcripts			Did not report taking science course found on their transcripts			Correctly reported not taking science course not found on their transcripts		
	2000	2005	2009	2000	2005	2009	2000	2005	2009	2000	2005	2009
Earth and space science	16*	22	23	12	14	14	5	6	6	66*	58	58
Life science (other than biology)	1	2	3	31*	38	36	2	2*	3	65*	58	58
Physical science (other than chemistry and physics)	41*	32	32	13*	17	17	8	11	10	38	40	40
General science <sup>1</sup>	8	10*	6	17	20*	14	6	6	7	69	63*	73
First-year biology	87	85*	89	4	5*	3	6	6	6	3*	3*	2
Second-year biology	17	16	15	11	11	11	14	15	17	58	58	57
First-year chemistry	67*	68*	73	4	6*	3	2	2	2	27*	24	22
Second-year chemistry	6	7*	5	7*	8	9	2	3*	1	85	82*	85
First-year physics	30	29*	34	5*	8	9	3*	2*	1	62*	61*	56
Second-year physics	2	2	3	4	4	4	1	3	2	93*	90	90
Science and technology/ Engineering and technology <sup>2</sup>	#*	#*	2	11	12	12	1*	1	2	88*	86	84

# Rounds to zero.

<sup>1</sup> Includes unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as “Science and technology” in 2000 and 2005 and as “Engineering and technology” in 2009. Considered similar categories for trend purposes.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: Details may not sum to total because of rounding. The “Other science course” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

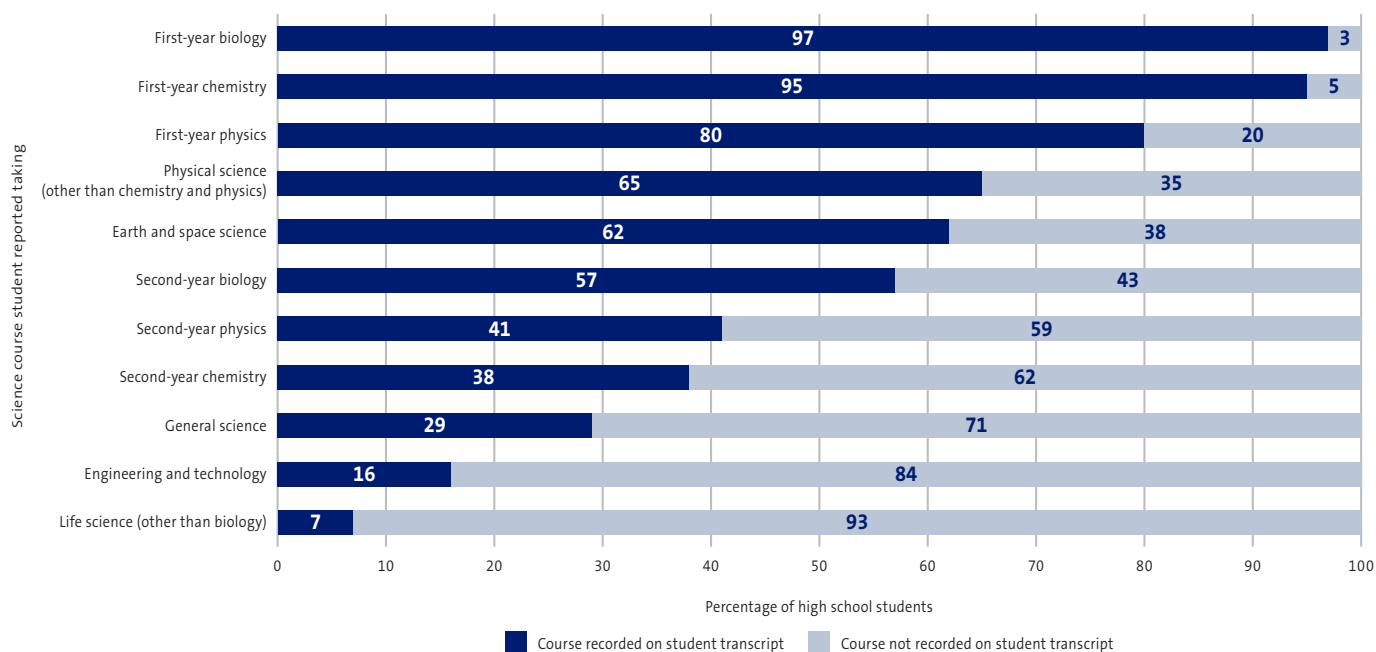
notable among those science courses was life science, where about 36 percent of the students reported taking a life science course that was not listed on their transcript. Figure 9 provides more information on this science course reporting error.

**Table 8** shows the percentage distribution of high school students’ science coursetaking in 2000, 2005, and 2009, based on comparisons between student-reported and transcript-recorded data. From 2000 to 2009, the percentage of students who correctly reported taking a science course

found on their transcripts rose for earth and space science, first-year chemistry, and engineering and technology, but fell for physical science courses. The percentage of students who reported taking life science, physical science, second-year chemistry, and first-year physics courses not found on their transcripts increased from 2000 to 2009, as did the percentage of students who did not report taking engineering and technology courses found on their transcripts.

About 95 percent of both first-year biology and chemistry courses reported by high school students were found on their transcripts.

**FIGURE 9.** Percentage of high school students who reported taking science courses that were recorded on their transcripts: 2009



NOTE: Details may not sum to total because of rounding. The “Other science course” category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 9** shows the percentages of high school students who reported taking science courses that had the courses recorded on their high school transcripts. This figure focuses on the science courses students reported they took.

As seen in figure 7, first-year biology and first-year chemistry were the two science courses most

often reported by high school students in 2009. For both courses, at least 95 percent of the student-reported courses were recorded on the students’ transcripts. While figure 7 shows that life science courses were reported taken by 39 percent of high school students in 2009, only 7 percent of the student-reported life science courses were found recorded on their high school transcripts.

A smaller percentage of first-year physics courses that high school students reported taking were recorded on their transcripts in 2009 than in 2000.

**TABLE 9.** Percentage of high school students who reported taking science courses that were recorded on their transcripts: 2000, 2005, and 2009

Science course student reported taking	2000	2005	2009
Earth and space science	57	60	62
Life science (other than biology)	4	6	7
Physical science (other than chemistry and physics)	76*	66	65
General science <sup>1</sup>	32	34	29
First-year biology	96	94*	97
Second-year biology	62	58	57
First-year chemistry	94	92*	95
Second-year chemistry	47	48*	38
First-year physics	85*	78	80
Second-year physics	36	37	41
Science and technology/ Engineering and technology <sup>2</sup>	4*	4*	16

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as “Science and technology” in 2000 and 2005 and as “Engineering and technology” in 2009. Considered similar categories for trend purposes.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: The “Other science courses” category is not shown.

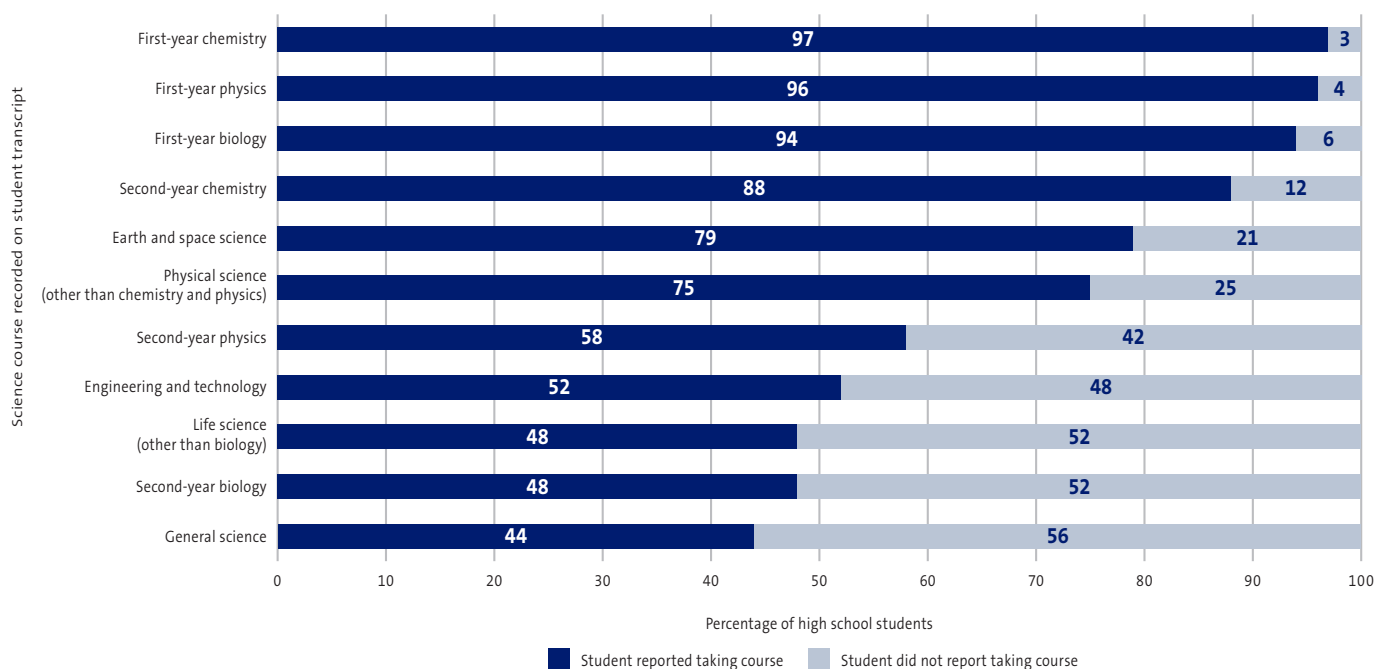
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**Table 9** shows the percentage of high school students in 2000, 2005, and 2009 who reported taking science courses that were recorded on their transcripts. As in figure 9, this table focuses on the science courses students reported they took. Compared to 2000, there was a smaller percentage of student-reported physical science and first-year

physics courses in 2009 that were recorded on the students’ transcripts. In addition, the percentage of student-reported life science courses matching the student transcripts have not significantly changed from 2000 to 2009.

More than 90 percent of students reported the first-year biology, chemistry, and physics courses recorded on their high school transcripts.

**FIGURE 10.** Percentage of high school students' transcripts where the recorded science courses were reported by students: 2009



NOTE: Details may not sum to total because of rounding. The "Other science course" category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 10** shows the percentage of high school students' transcripts where the science courses recorded on their transcripts were reported by the students on the NAEP twelfth-grade science assessment student questionnaire. Unlike the previous figure, which looks at the science courses students reported they took, this figure focuses on the science courses found on the students' transcripts.

First-year biology, chemistry, and physics courses are three of the four most common science courses appearing on high school transcripts in 2009. Among the students whose transcripts listed those courses, at least 90 percent reported taking the courses. For second-year chemistry, earth

and space science, and physical science courses, among the students whose transcripts listed those courses, at least 75 percent reported the courses. Only about half the life science, second-year biology, and general science courses recorded on high school transcripts were reported by students.

As seen in figures 9 and 10, half of the students whose transcripts contained life science courses reported taking life science courses, while only 7 percent of students who reported taking life science courses had such courses recorded on their transcripts. These percentages suggest that students may not clearly understand what life science courses are.

A higher percentage of high school students reported first-year physics courses recorded on their transcripts in 2009 than in 2000.

**TABLE 10.** Percentage of high school students' transcripts where the recorded science courses were reported by students: 2000, 2005, and 2009

Science course recorded on student transcript	2000	2005	2009
Earth and space science	77	79	79
Life science (other than biology)	39	59	48
Physical science (other than chemistry and physics)	84*	75	75
General science <sup>1</sup>	56*	63*	44
First-year biology	94	93	94
Second-year biology	55*	50	48
First-year chemistry	97	97	97
Second-year chemistry	79	71*	88
First-year physics	92*	93*	96
Second-year physics	59	41*	58
Science and technology/ Engineering and technology <sup>2</sup>	36	31*	52

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as "Science and technology" in 2000 and 2005 and as "Engineering and technology" in 2009. Considered similar categories for trend purposes.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: The "Other science courses" category is not shown.

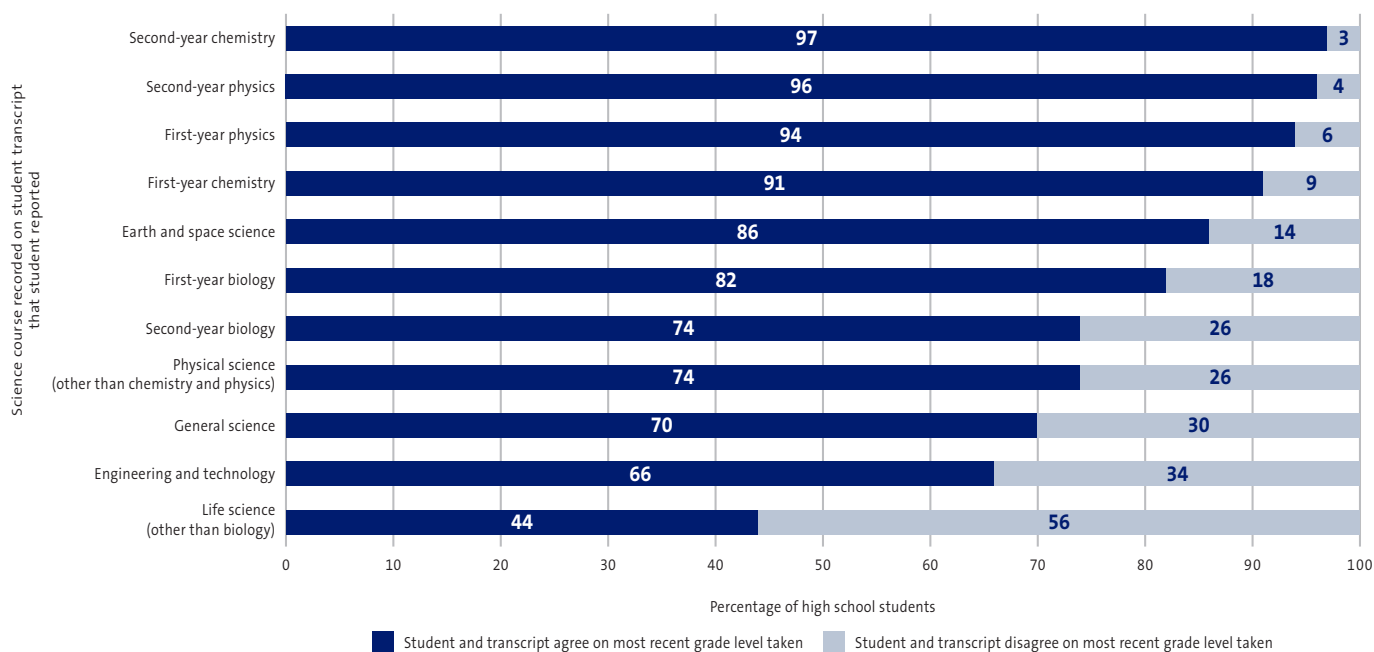
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**Table 10** shows the percentage of high school students' transcripts in 2000, 2005, and 2009 where the recorded science courses were reported by students. Compared to 2000, a higher percentage of high school students in 2009 reported the first-year physics courses recorded on their transcripts, while a lower percentage reported their physical science and second-year biology courses. For science courses like life science, general science, second-year chemistry, and second-year physics, the percentage of students who reported taking the courses recorded on their transcript showed no clear pattern between 2000, 2005, and 2009.

Similar to mathematics courses, when high school students take science courses is a major factor associated with their performance on the NAEP twelfth-grade science assessment. Therefore, it is important to determine how accurately students reported the most recent grade level they took science courses. Based on the high school students' transcripts in 2009 where the recorded science courses were also reported by the students, **figure 11** shows the percentages of those transcripts where the most recent grade level recorded on the transcript matches the most recent grade level reported by the student.

## High school students best recalled the most recent grade level of chemistry and physics courses.

**FIGURE 11.** Percentage of high school students' transcripts where the recorded science courses were reported by students, by the reported most recent grade level taken: 2009



NOTE: Details may not sum to total because of rounding. The "Other science course" category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

At least 90 percent of high school students correctly identified the most recent grade level taken of chemistry and physics courses recorded on their transcripts, ranging from 91 percent for first-year chemistry courses to 97 percent for second-year chemistry courses. Chemistry and physics courses are generally taken after a student

completes first-year biology, which is usually in the last 2 years of high school. For science courses generally taken in the first year of high school, the percentages of students who correctly reported the most recent grade level the course was taken ranged from 44 percent (life science) to 86 percent (earth and space science).

The match rate on the most recent grade level taken between students and transcripts decreased from 2000 to 2009 for three science courses.

**TABLE 11.** Percentage of high school students' transcripts where the recorded science courses were reported by students and agreed on the most recent grade level taken: 2000, 2005, and 2009

Science course recorded on student transcript and reported by student with the same most recent grade level taken	2000	2005	2009
Earth and space science	89	85	86
Life science (other than biology)	68*	47	44
Physical science (other than chemistry and physics)	82*	78	74
General science <sup>1</sup>	64	68	70
First-year biology	83	82	82
Second-year biology	76	76	74
First-year chemistry	93*	92	91
Second-year chemistry	96	94	97
First-year physics	96	96	94
Second-year physics	97	95	96
Science and technology/ Engineering and technology <sup>2</sup>	36*	56	66

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as "Science and technology" in 2000 and 2005 and as "Engineering and technology" in 2009. Considered similar categories for trend purposes.

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: The "Other science courses" category is not shown.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

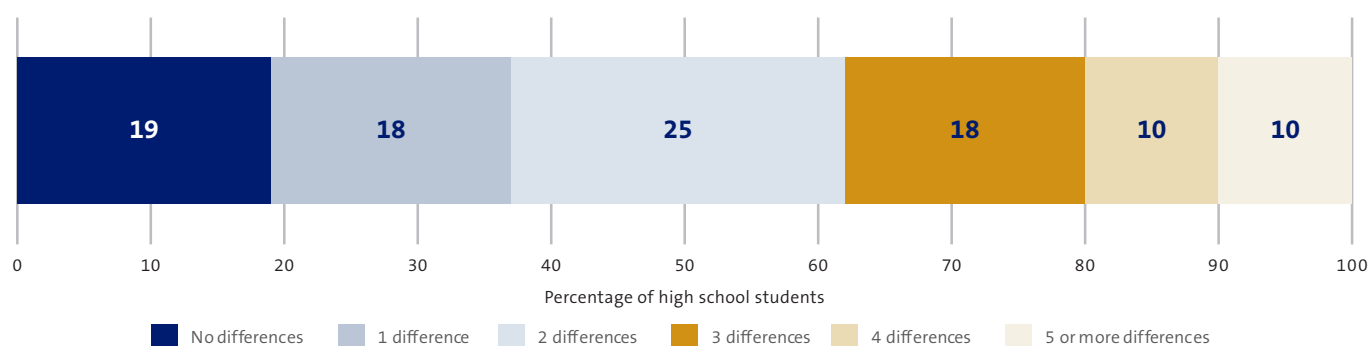
Based on the high school students' transcripts in 2000, 2005, and 2009 where the recorded science courses were reported by the students, [table 11](#) shows the percentages of those transcripts where the students and transcripts agreed on the most recent grade level the courses were taken. Between 2000 and 2009, there were decreases in

the percentage of students who correctly reported the most recent grade level they took life science, physical science, and first-year chemistry courses. The differences ranged from 2 percentage points (first-year chemistry) to about 24 percentage points (life science).



About 37 percent of students reported their science courses correctly or only had one difference with their transcript records.

**FIGURE 12.** Percentage distribution of overall number of differences between student-reported and transcript-recorded science courses taken: 2009



NOTE: Details may not sum to total because of rounding. A difference between student-reported and transcript-recorded courses occurs when a student either reports a science course not recorded on his or her transcript or does not report taking a science course recorded on his or her transcript. Five or more differences between student-reported and transcript-recorded courses were collapsed into a single category primarily for graphical display purposes.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 12** shows the percentage of high school students in 2009 broken down by the number of differences found between the science courses they reported on the NAEP student questionnaire and the science courses recorded on their transcripts. A difference occurred when a student either reported taking a course that was not recorded on his or her transcript or did not report a course that was recorded on the transcript. The analyses presented in this figure focus only on the courses and do not look at the most recent grade level a course was taken.

In 2009, about 37 percent of high school students who reported science courses either exactly matched the transcript-recorded science courses or only had one difference, while about 38 percent had three or more differences between what they reported and their transcripts recorded.

A higher percentage of high school students accurately reported the science courses on their transcripts in 2000 than in 2009.

**TABLE 12.** Percentage distribution of overall number of differences between student-reported and transcript-recorded science courses taken: 2000, 2005, and 2009

Number of differences	Science		
	2000	2005	2009
0	26*	19	19
1	20*	18	18
2	23	25	25
3	15*	17	18
4	8*	11	10
5 or more	7*	10	10

\* Significantly different ( $p < .05$ ) from associated 2009 value.

NOTE: A difference between student-reported and transcript-recorded courses occurs when a student either reports a course not recorded on his or her transcript or did not report taking a course recorded on his or her transcript. Details may not sum to total because of rounding.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**Table 12** shows the percentage distribution of high school students in 2000, 2005, and 2009 by the number of differences found between their self-reported and transcript-recorded science courses. Compared to 2000, there was a

10 percentage point decrease among high school students in 2009 with zero or one difference and an 8 percentage point increase among high school students with three or more differences.

# Analyzing Student-Reported and Transcript-Recorded Coursework

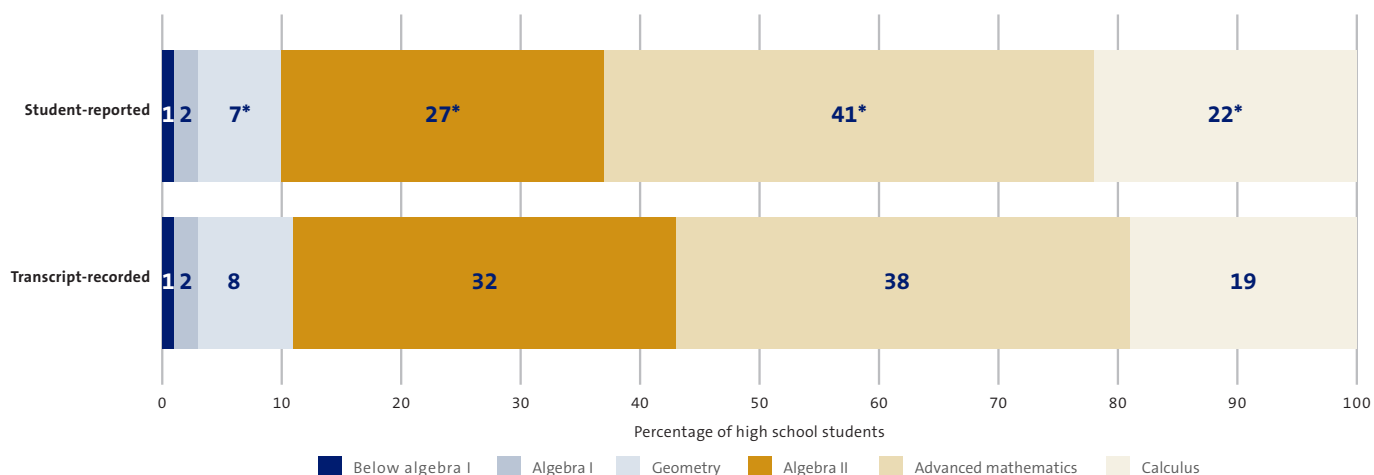
While transcripts remain the most reliable measure of high school students' coursework, the time and effort in obtaining high school transcripts can be burdensome. The cost of transcript data collections and the burden on schools to provide the transcripts are just two factors that highlight the need to explore other sources of course information, such as the student coursetaking questions on the NAEP assessments' student questionnaire. As shown in the previous section of this report, however, about seven in ten high school students in 2009 may have incorrectly reported the mathematics courses recorded on their transcripts, while about four in five students may have incorrectly reported their science courses. The majority of high school students had one or more differences between the mathematics or science courses they reported they took and that were recorded on their transcripts. These differences may affect the understanding of the relationship between coursetaking and achievement. For example, differences between students' reported courses and their transcripts may result in discrepancies between the student-reported information and transcripts in the highest-level course taken.

To highlight the effects of these differences, the analyses presented in this section compare student-reported and transcript-recorded mathematics and science coursetaking in 2009 using measures and analyses commonly reported by researchers. Specifically, this section examines (a) measures of the highest course reached in mathematics and science and (b) relationships between mathematics and science coursetaking and NAEP achievement, using both student-reported and transcript-recorded courses.

In addition to reporting on individual courses, education researchers may look at summary coursetaking measures. One such coursetaking measure is the highest-level course a student has taken during high school within a subject.

Higher percentages of students reported reaching advanced mathematics and calculus than was indicated by their transcripts.

**FIGURE 13.** Percentage distribution of high school students by highest-level mathematics course taken, based on student-reported and transcript-recorded data: 2009



\*Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: Details may not sum to total because of rounding. Advanced mathematics includes courses, other than calculus, that are generally taken after algebra II (e.g., AP statistics, trigonometry, precalculus).

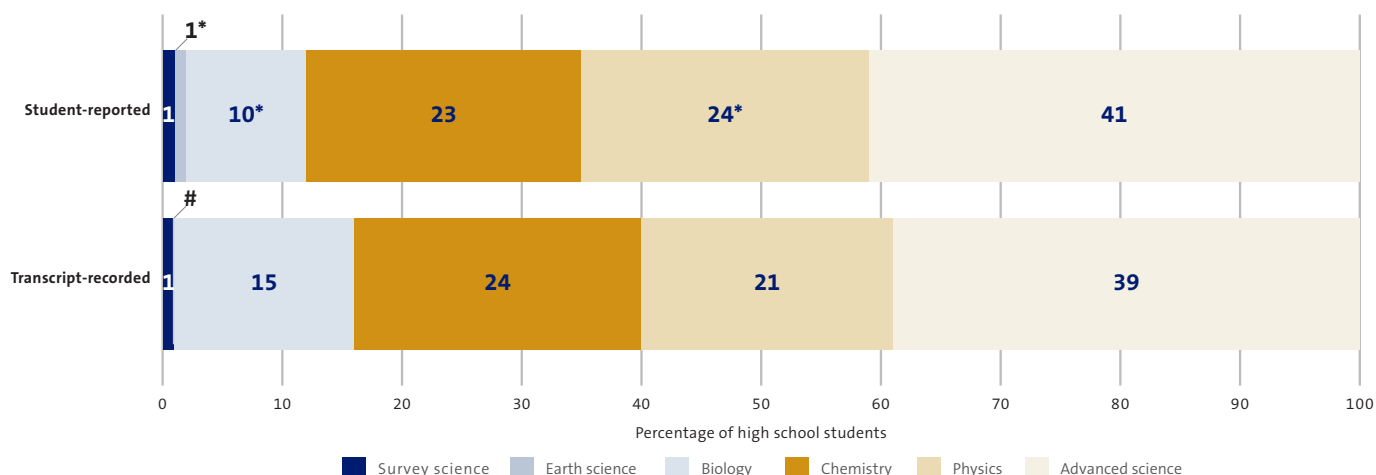
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 13** shows the percentage distribution of high school students in 2009 separated by their highest-level mathematics course taken, and compares the mathematics courses students reported taking with the mathematics courses recorded on their transcripts. In 2009, the percentages of students who reported taking advanced mathematics or calculus as their

highest-level mathematics course were higher than the percentages reported using the courses recorded on their transcripts. In contrast, the percentages of students who reported taking geometry and algebra II as their highest-level mathematics course were lower than was indicated by their transcripts.

## Reports of the highest-level science course taken would change if student-reported data were used instead of transcript data.

**FIGURE 14.** Percentage distribution of high school students by highest-level science course taken, based on student-reported and transcript-recorded data: 2009



\* Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: Details may not sum to total because of rounding. Survey science includes life science, physical science, and general science courses. Advanced science courses are courses that contain advanced content (e.g., AP biology, IB chemistry, AP physics) or are considered second-year courses (e.g., chemistry II, advanced biology).

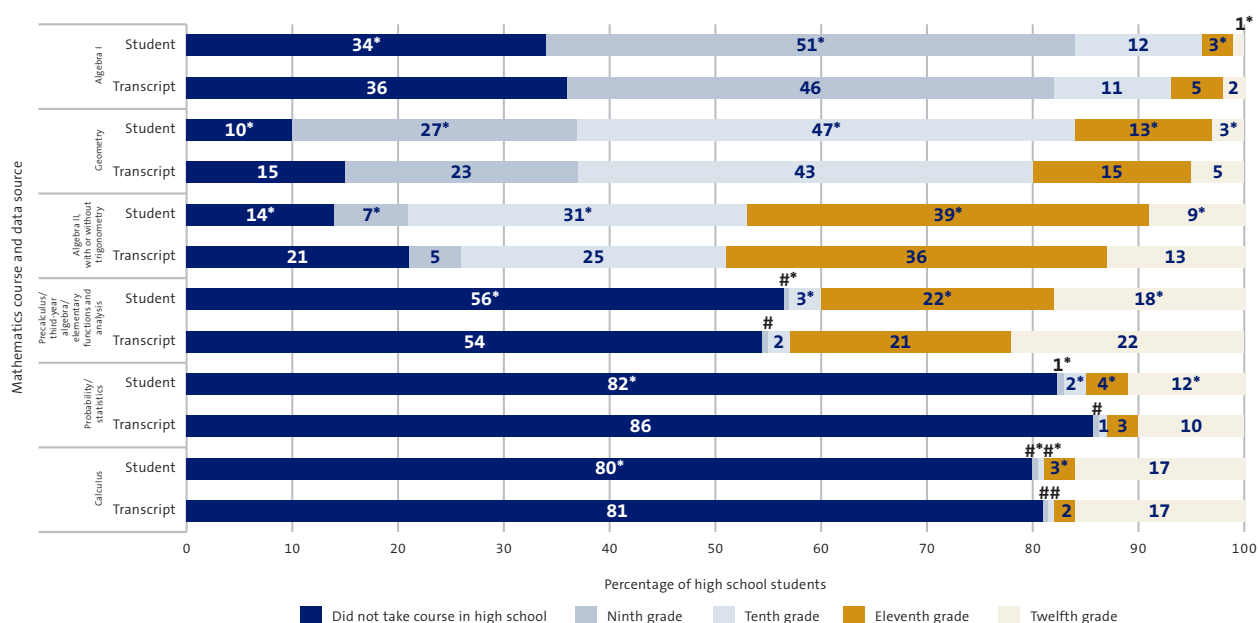
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 14** shows the percentage distribution of high school students in 2009 by their highest-level science courses taken, comparing the science courses students reported taking with the science courses recorded on their transcripts. The percentage of students who reported physics as their highest science course was higher than the percentage based on their transcripts (24 percent versus 21 percent). In contrast, the percentage of students who reported biology as their highest-level science course was lower than the percentage based on their transcripts (10 percent versus 15 percent).

As discussed earlier in this report, when a student takes mathematics courses may be a factor in their performance on the NAEP mathematics assessment. Differences between the grade levels students reported taking a course and transcripts showing when the course was taken, therefore, may affect the importance of this factor.

Differences exist between student-reported and transcript-recorded data in the most recent grade levels that mathematics courses were taken.

**FIGURE 15.** Percentage distribution of high school students across the most recent grade levels selected mathematics courses were taken, based on student-reported and transcript-recorded data: 2009



# Rounds to zero.

\* Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: Details may not sum to total because of rounding.

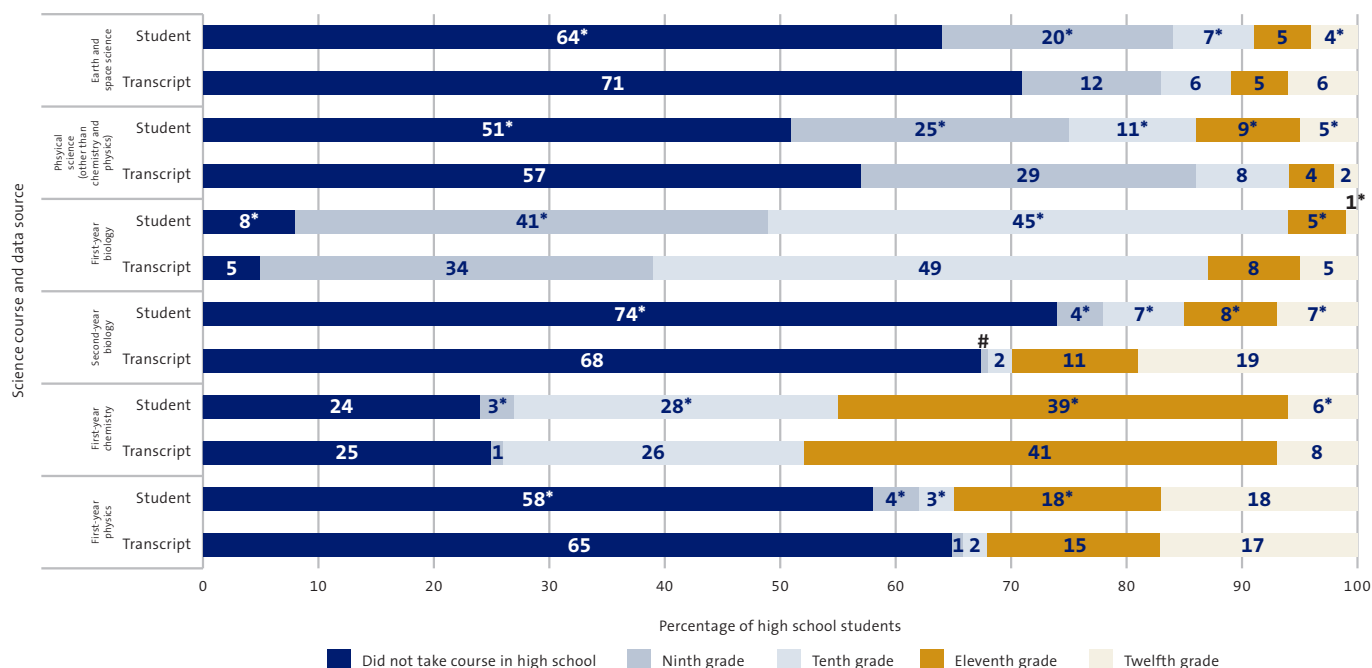
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 15** shows the percentage distribution of high school students in 2009 taking selected mathematics courses by the most recent grade level the courses were taken, as reported by the students and recorded on their high school transcripts. The selected mathematics courses were the six most common mathematics courses found on high school students' transcripts in 2009—algebra I, geometry, algebra II, precalculus, probability/statistics, and calculus. Table E7 in appendix E contains the percentage distributions for all mathematics courses.

For each selected mathematics course, the percentage distribution of the most recent grade level taken reported by the high school students was statistically significantly different from the percentage distribution recorded on their transcripts. However, for algebra I, algebra II, and geometry, the most recent grade level with the largest percentage of students was similar for both student-reported and transcript-recorded data. For algebra I (ninth grade), geometry (tenth grade), and algebra II (eleventh grade), a higher percentage of students reported taking those courses while in those grade levels than was recorded on their transcripts.

The most recent grade levels in which second-year biology courses were taken differed significantly between student-reported and transcript-recorded data.

**FIGURE 16.** Percentage distribution of high school students across the most recent grade levels selected science courses were taken, based on student-reported and transcript-recorded data: 2009



# Rounds to zero.

\* Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: Details may not sum to total because of rounding.

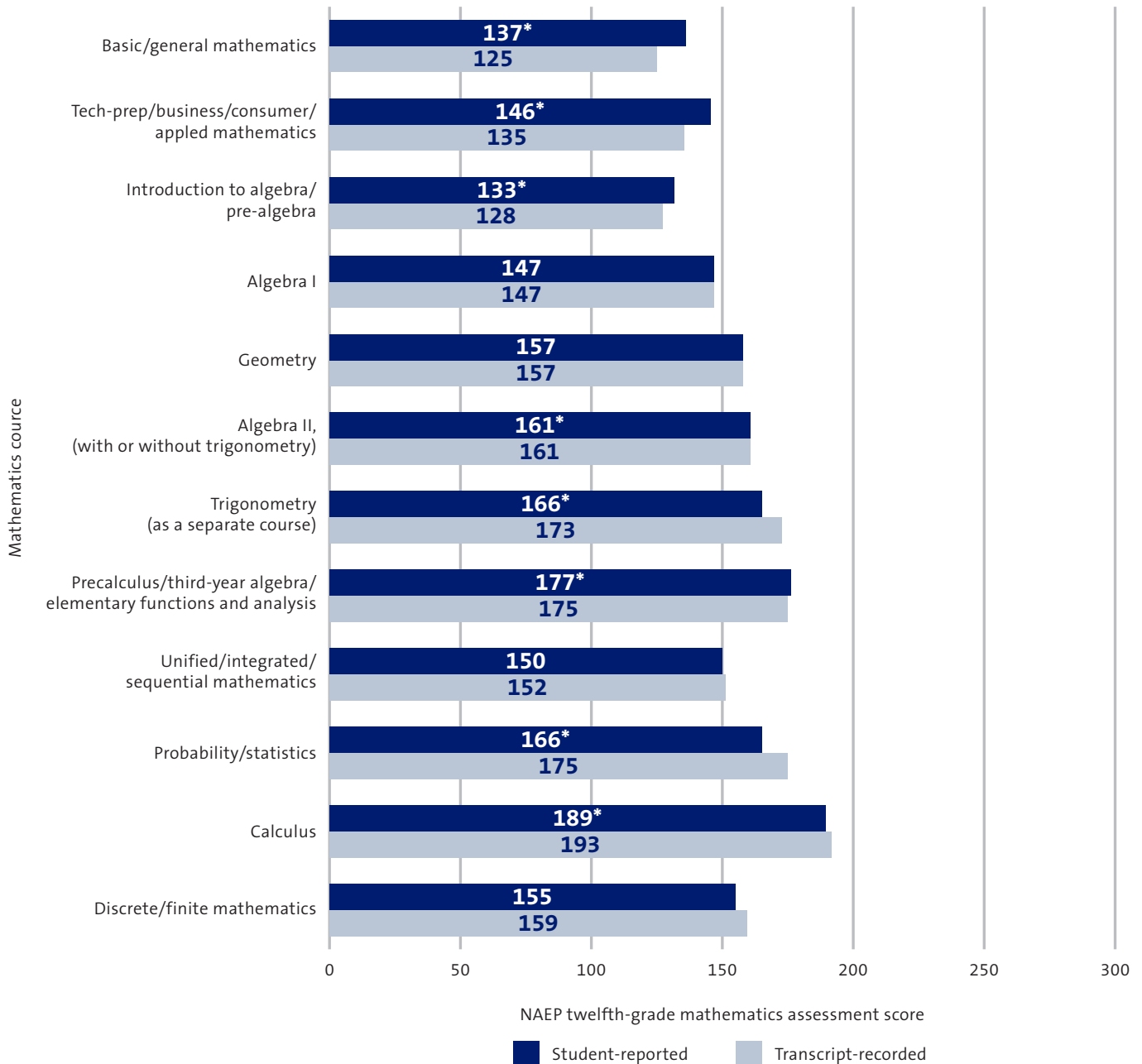
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

**Figure 16** shows the percentage distribution of high school students in 2009 taking selected science courses by the most recent grade level taken, comparing what was reported by the students and what was recorded on their transcripts. The selected science courses were the six most common science courses found on the students' transcripts in 2009—earth and space science, physical science, first- and second-year biology, first-year chemistry, and first-year physics. Table F7 in appendix F contains the percentage distributions for all science courses.

For each selected science course, the percentage distribution of the most recent grade level taken reported by the high school students was statistically significantly different from the percentage distribution recorded on their transcripts. However, for first-year biology and chemistry courses, the most recent grade level with the largest percentage of students was similar for both student-reported and transcript-recorded data. Both data sources reported the largest percentage of students indicating tenth grade as the most recent grade level taken for

The mean NAEP twelfth-grade mathematics assessment scores for students who reported taking probability/statistics and calculus courses were lower than the mean scores for students whose transcripts recorded the courses.

**FIGURE 17.** Mean NAEP twelfth-grade mathematics assessment scores of high school students, by student-reported and transcript-recorded mathematics courses: 2009



\* Significantly different ( $p < .05$ ) from transcript-recorded value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.



first-year biology courses, and eleventh grade for first-year chemistry courses. The percentage of students reporting taking those courses in those grades was lower than the percentage recorded on their transcripts.

Using student responses instead of transcript data could not only affect mathematics and science coursetaking measures but also the relationship to NAEP scores. **Figure 17** shows the mean NAEP twelfth-grade mathematics assessment scores of high school students in 2009 based on the mathematics course they took, comparing the student-reported mathematics courses with the mathematics courses recorded on their transcripts. For the three most common mathematics courses found on students' transcripts in 2009—algebra I, geometry, and algebra II—only algebra II courses showed a statistically significant difference in the NAEP mathematics assessment score based on student-reported (160.9) and transcript-recorded (161.3) courses. Among other mathematics courses, the mean NAEP mathematics assessment score for students who reported taking calculus courses was 4 points lower than the score for the students whose transcripts recorded a calculus course. The mean NAEP mathematics assessment score for students who took probability/statistics courses was 9 points higher among the transcript-recorded courses than among the student-reported courses, while the mean NAEP mathematics assessment score for students who took basic/general mathematics was 12 points lower for transcript-recorded courses than for student-reported courses.

**Figure 18** shows the mean NAEP twelfth-grade science assessment scores of high school students in 2009 based on the science courses they took and comparing the student-reported science courses with the transcript-recorded science courses. For the three most common science courses listed on high school students' transcripts

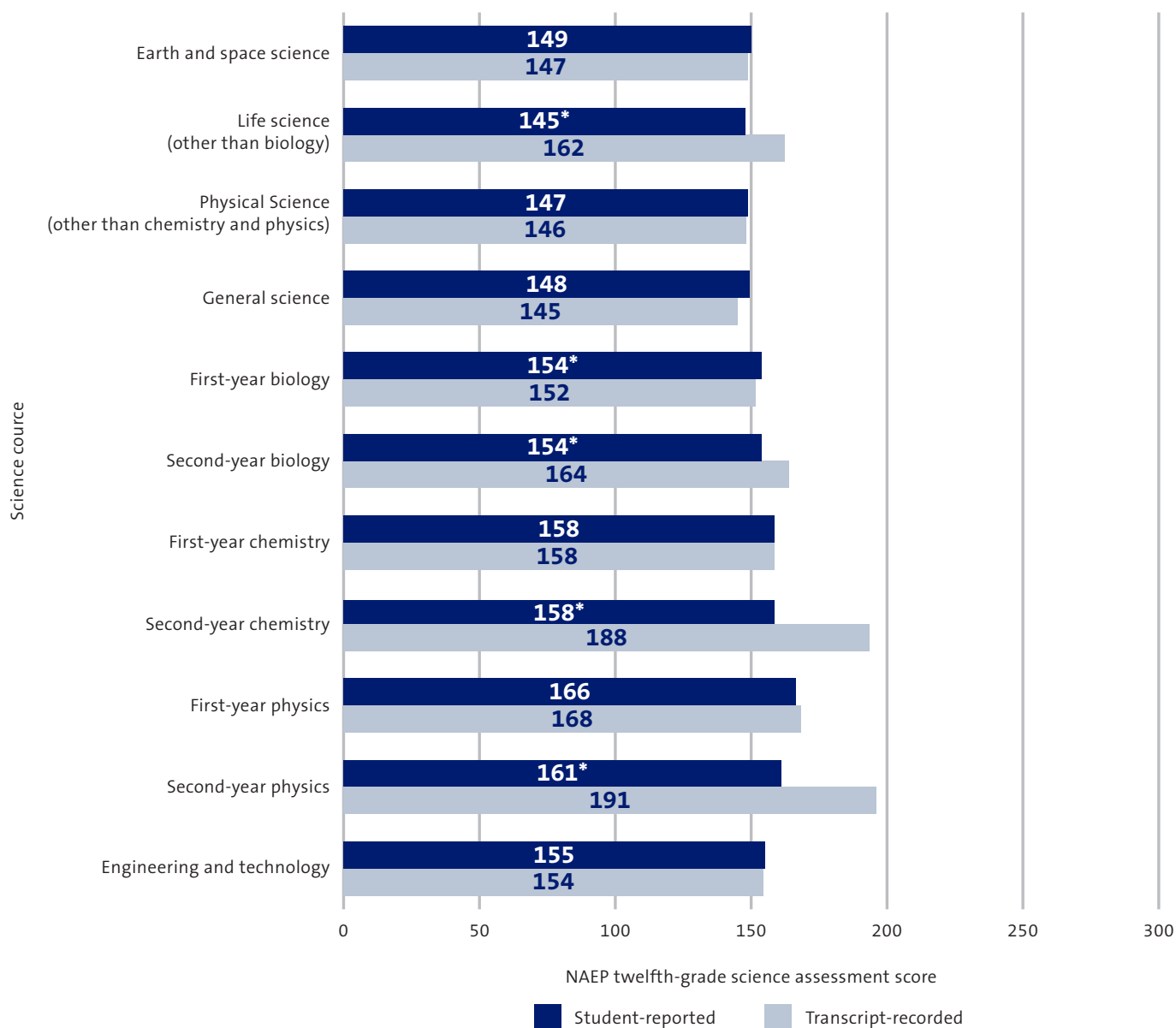
in 2009—physical science, first-year biology, and first-year chemistry—a difference in NAEP science assessment scores between student-reported and transcript-recorded data was evident only for reported first-year biology courses. The mean NAEP science assessment scores for students were higher among the transcript-recorded second-year laboratory science coursetaking compared to the student-reported coursetaking. The differences in the mean NAEP science assessment scores between student-reported and transcript-recorded second-year laboratory science courses ranged from 10 points (second-year biology) to 29 points (both second-year chemistry and physics courses).

**Figure 19** shows the mean NAEP twelfth-grade mathematics assessment scores for high school students in 2009 by the highest-level mathematics course taken, when using the mathematics reported by students and recorded by their transcripts. In 2009, the average NAEP mathematics score of students who had calculus courses recorded on their transcripts was 193. For students who reported taking a calculus course, the average score was 185, which is 8 points lower. As seen in figure 1, the transcripts recorded a smaller percentage of students taking calculus courses than did the student self-reports. Because NAEP HSTS analyses have shown that students who did not take calculus had lower NAEP mathematics scores on average than students who took calculus (Nord et al. 2011), the inclusion of students who did not take a calculus course in the calculus-taking group would likely result in a lower average NAEP mathematics score. Similarly, the average NAEP mathematics score of students whose transcripts showed that advanced mathematics was their highest-level mathematics course was 162, compared to an average score of 160 when using the student-reported data.

For students who reported that their highest mathematics course was below algebra I, their

For some science courses, the mean NAEP twelfth-grade science assessment scores for students who reported taking the courses were lower than the mean scores for students whose transcripts recorded the courses.

**FIGURE 18.** Mean NAEP twelfth-grade science assessment scores of high school students, by student-reported and transcript-recorded science courses: 2009

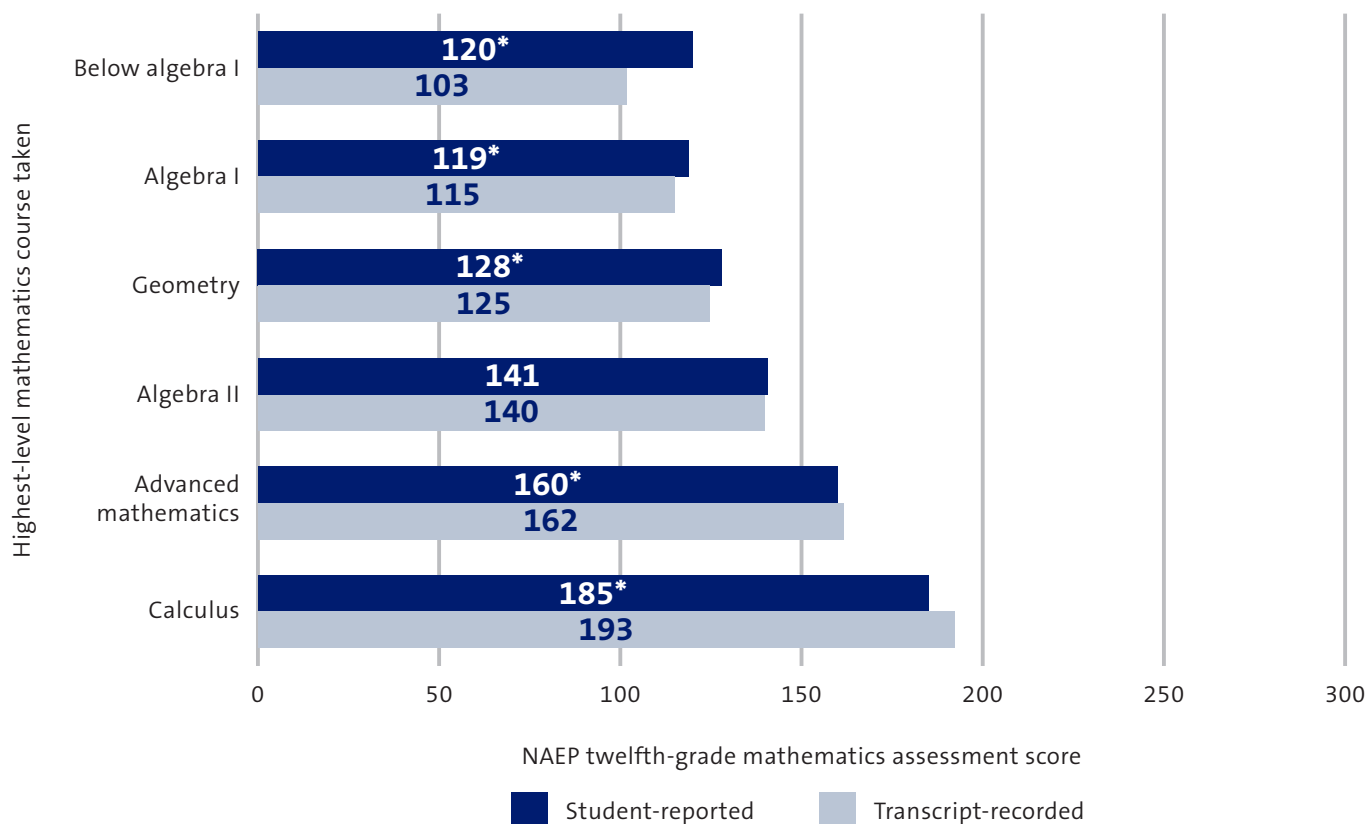


\* Significantly different ( $p < .05$ ) from transcript-recorded value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

NAEP mathematics assessment scores were lower for students who reported advanced mathematics or calculus as their highest-level mathematics course taken compared to transcript-recorded data.

**FIGURE 19.** Mean NAEP twelfth-grade mathematics assessment scores of high school students, by the highest-level mathematics course taken according to student-reported and transcript-recorded measures: 2009



\* Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: Advanced mathematics includes courses, other than calculus, that are generally taken after algebra II (e.g., AP statistics, trigonometry, precalculus).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

average NAEP mathematics score was 120, compared to the average score of 103 when using transcript-recorded data. Similar patterns were observed for those students whose highest-level mathematics course was algebra I (119 for student-reported versus 115 for transcript-recorded) and geometry (128 versus 125). While the NAEP scores for students who reported their highest course was below algebra I and those who reported their highest-level course was algebra I are similar, the NAEP scores when using transcript-recorded data show a significant 13-point gap.

Figure 20 shows the mean NAEP twelfth-grade science assessment scores for high school students in 2009 by the highest-level science course they took, when reported by students and as recorded by transcripts. The average NAEP science score of students who reported advanced science as their highest-level science course taken (159) was 8 points lower than the average score for students whose transcripts recorded the same highest course level (167). In contrast, there were higher average scores for students who reported either biology or chemistry as their highest-level science

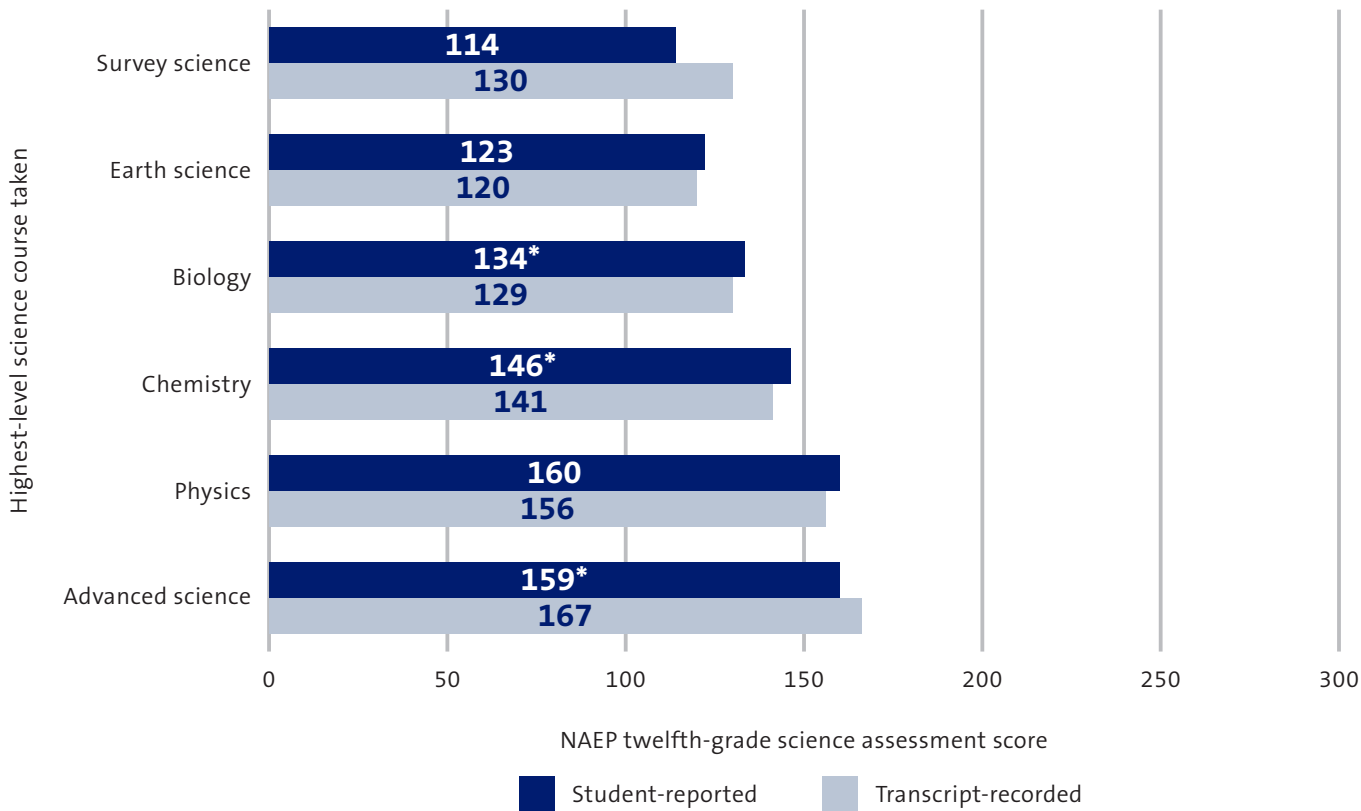
courses taken when using student-reported data as compared to when using the transcript-recorded data.

According to the student-reported data, students who indicated that their highest-level science course taken was advanced science had an average score of 159 on the 2009 NAEP twelfth-grade science assessment. The score is similar to the average score of 160 earned by students who indicated that their highest-level science course

taken was physics. However, when determining the students' highest-level science course taken by the science courses recorded on their transcripts, the students whose highest-level course was advanced science had an average score (167) that was 10 points higher than the average scores of students whose highest-level course was physics (156). This significant finding would not have been uncovered if the student-reported data had been used.

Differences were found between the mean NAEP twelfth-grade science assessment scores of students who reported taking biology, chemistry, and advanced science courses and students whose transcripts recorded those science courses.

**FIGURE 20.** Mean NAEP twelfth-grade science assessment scores of high school students, by the highest-level science course taken according to student-reported and transcript-recorded measures: 2009



\* Significantly different ( $p < .05$ ) from transcript-recorded value.

NOTE: Survey science includes life science, physical science, and general science courses. Advanced science courses are courses that contain advanced content (e.g., AP biology, IB chemistry, AP physics) or are considered second-year courses (e.g., chemistry II, advanced biology).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2009.

# CONCLUSION

Researchers use information about high school students' educational experiences to better understand NAEP student assessment data. Coursework and other demographic data reported by students must be accurate to ensure high-quality analyses of the relationship between students' educational experiences and their performance on NAEP. To assess the validity of the student-reported coursetaking data, this study compared the student-reported data to coursetaking data collected through student transcripts by the NAEP High School Transcript Study.

In general, the mathematics and science courses students reported taking did not match with the mathematics and science courses recorded on their transcripts. About 45 percent of students had two or more discrepancies between their self-reported and transcript-recorded mathematics courses, while 63 percent had two or more discrepancies among science courses. At least 90 percent of the students reported the algebra I, geometry, and algebra II courses recorded on their transcripts; however, the percentages of students who reported taking the courses were higher than the percentages recorded on their transcripts. While at least 90 percent of students reported the first-year biology, chemistry, and physics courses recorded on their transcripts, the student-reported percentage of first-year physics courses taken was higher than the transcript-recorded percentage, while the student-reported percentage of first-year biology courses taken was lower than the transcript-recorded percentage. Seven times more students self-reported taking life science courses than actually had life science courses on their

transcripts. At the same time, of the students who actually had life science courses on their transcripts, only half of the students self-reported taking the course. The large errors in self-reporting in both directions makes the reporting of life science courses particularly concerning.

Analyses showed significant differences in mathematics and science coursetaking between student-reported and transcript-recorded courses. Compared to the mathematics and science courses recorded on their transcripts, a higher percentage of students indicated that they took a mathematics class more advanced than algebra II (e.g., precalculus or calculus), while a lower percentage of students indicated that first-year biology was their highest-level science course. The NAEP twelfth-grade mathematics assessment scores of students who indicated taking probability/statistics and calculus courses were lower than the scores of students whose transcripts recorded those courses. Similarly, the NAEP twelfth-grade science assessment scores of students who reported taking second-year biology, chemistry, and physics courses were lower than the scores of students whose transcripts recorded those courses. Similar findings were found when looking at the NAEP assessment scores by the highest-level mathematics and science courses taken.

The NAEP program was made aware that student-reported coursetaking data may be problematic; therefore, NAEP regularly evaluates the self-reported coursetaking questions to identify ways to reduce recall error, misunderstanding, and response bias. For example, in 2013, the NAEP mathematics student questionnaire

further differentiated the “Unified, integrated, or sequential mathematics course” response option by expanding it to four separate options (i.e., first-, second-, third- and fourth-year integrated mathematics). Additionally, the “Other mathematics course” response option was modified to add an open response that allows students to write in the name of the course they took. The latter change will allow researchers to see what courses students think are not covered by the current coursetaking response options. Appendix G shows the table of student responses to the mathematics coursetaking question on the 2013 NAEP twelfth-grade mathematics student questionnaire and how it compares to previous years’ responses.

In light of the study findings, this report offers the following considerations for researchers interested in using NAEP or other student coursetaking data:

**When available and feasible, transcript data should be the primary source used when reporting student coursetaking information.**

Coursetaking information based on student transcripts should be used as the primary source to report student coursetaking patterns. Unlike student-reported data, transcript data are not influenced by students’ recall ability, inflation of coursework, or interpretation of course titles that may not reflect course content. For NAEP, HSTS data and analysis tools are available for the 2000, 2005, and 2009 twelfth-grade administrations of mathematics and science assessments.

**When transcript data are not available or feasible, student-reported coursetaking information can be used with an appropriate acknowledgement of potential limitations to self-reported data.**

When student-reported coursetaking data are used, the data should only be used for general-level results, such as the overall student coursetaking patterns reported in figures 1 and 7 of this report. Analyses that are more specific, such as measuring the frequency of mathematics and science course sequences, would likely be more affected by students’ inconsistencies in reporting their courses. In addition, validity issues associated with the data should be stated; appropriate cautions about the interpretation of the data should accompany each data display. The cautions should note that students may report courses that they did not take or fail to report courses that they did take.

Student transcript data may not be available as often as needed. For example, because NCES high school transcript studies are periodic and not conducted every year, coursetaking data from student transcripts are not always available for a given reporting year to provide context for the NAEP twelfth-grade assessment data. When student transcript data are available, it may not be feasible in terms of time, effort, and costs to incorporate and analyze the transcript data. Therefore, student-reported coursetaking data may be a more readily available source of information.

## **Validation research comparing transcript-recorded coursetaking with student self-reported coursetaking should be continued to identify possible improvements in the collection of self-reported coursetaking data.**

While this study did not examine why mismatches occurred between student-reported and transcript-recorded coursetaking, previous research has pointed to student recall ability, the title of the school course, and how long ago the course was taken (Niemi and Smith 2003, Paulhus and Vazire 2007). These issues are student- and school-focused, and solutions generally fall outside the means of school assessments. Studies that compare student-reported and transcript-recorded coursetaking can lead to revisions in coursetaking questions that improve the student's understanding about what courses they have taken, leading to better quality of the coursetaking data collected.

Based on this study, below are suggested changes that could be made to the NAEP mathematics and science coursetaking questions that may lead to improvements in the quality and validity of student-reported data:

-  Revise the list of mathematics and science courses to better reflect course titles used by most schools. This may increase the level of course recognition for the students.
-  Revise the course descriptions to help students identify the courses they have taken. School course titles vary for similar courses, or several courses are often grouped together. This may reduce the number of courses listed in the “other course” response option. For example, revise the “second-year biology” response option to read, “second-year or specialized biology (e.g., genetics, human physiology)” so that students taking either a biology II course or a human physiology course understand this option.
-  Change the “other course” response option to an open response in the NAEP science student questionnaire. This will allow students to write in the name of the course they took.
-  Consider removing the response option for students to indicate when they took each course listed. The accuracy of this information is often affected by recall ability. Currently, the questionnaires ask students to recall two pieces of information: what courses they took, and the most recent grade level they took each course. This study showed that students were better at recalling the courses they took than when they took the courses. If the most recent grade level option remains, consider adding an example of how to answer if a course is taken more than once (such as a two-year algebra I course or two second-year biology courses).



# TECHNICAL NOTES

## Analytic Samples

The findings of this study were generated from nationally representative samples of twelfth-grade students in the 2000, 2005, and 2009 HSTS who also participated in the NAEP twelfth-grade mathematics and science assessments. An eligible twelfth-grade student was defined by the same inclusion criteria used for the HSTS. Only twelfth-grade students who graduated with a regular or honors diploma, earned at least 16 Carnegie credits, and earned a positive number of credits in English courses were eligible for the analytic samples. Because the comparisons between the student-reported responses and the transcripts required verifying if a student did not take a selected mathematics or science course, an additional requirement for eligibility was that the student's transcript contained courses for all four grade levels of high school (i.e., ninth through twelfth grade).

The 2000 analytic sample comprised about 6,000 students who took the NAEP mathematics assessment and 7,400 students who took the NAEP science assessment. The 2005 analytic sample comprised about 6,900 students for the mathematics assessment and 10,000 students for the science assessment, while the 2009 analytic sample comprised about 20,800 students for the mathematics assessment and 8,400 students for the science assessment.

## Compatibility Across Student Responses

As part of the student questionnaire in the NAEP twelfth-grade mathematics and science assessments, students are asked which courses related to the assessment they took from the eighth through twelfth grades. On the 2005 and 2009 NAEP mathematics assessments, the 13 mathematics courses that were listed are as follows:

- ♦ Basic or general mathematics
- ♦ Tech-prep, business, consumer, or applied mathematics
- ♦ Introduction to algebra or pre-algebra
- ♦ Algebra I
- ♦ Geometry
- ♦ Algebra II, with or without trigonometry
- ♦ Trigonometry as a separate course
- ♦ Precalculus
- ♦ Unified, integrated, or sequential mathematics
- ♦ Probability or statistics
- ♦ Calculus
- ♦ Discrete or finite mathematics
- ♦ Other mathematics courses

On the 2000 NAEP mathematics assessment student questionnaire, the listing for “Tech-prep, business, consumer, or applied mathematics” courses appeared instead as separate listings for “Business or consumer mathematics” and “Applied or tech-prep mathematics” courses. The two course listings were combined for the 2000 NAEP mathematics assessment so that it would be compatible with the 2005 and 2009 NAEP



mathematics course listings. Appendix A lists the mathematics coursetaking question as it appeared in the 2009 NAEP twelfth-grade mathematics assessment's student questionnaire.

On the 2009 NAEP science assessment, the 12 science courses that were listed are as follows:

- ◆ Earth and space science
- ◆ Life science (other than biology)
- ◆ Physical science (other than chemistry or physics)
- ◆ General science
- ◆ First-year biology
- ◆ Second-year biology
- ◆ First-year chemistry
- ◆ Second-year chemistry
- ◆ First-year physics
- ◆ Second-year physics
- ◆ Engineering and technology
- ◆ Other science courses

In the 2000 and 2005 NAEP science assessments, the “Engineering and technology” course was listed as a “Science and technology” course. As engineering courses are considered science and technology courses, these two courses were considered to be equivalent for the purposes of trend measures. A “Unified science” course option also appeared in the 2000 and 2005 NAEP assessments, but not in the 2009 NAEP assessment. Given that general science and unified science courses basically cover the same material, the general and unified science courses were combined for 2000 and 2005 NAEP for the purpose of establishing trend data. Appendix B lists the science coursetaking question as it appeared in the 2009 NAEP twelfth-grade science assessment's student questionnaire.

For the analyses concerning the mathematics and science courses listed on the NAEP assessments,

if a student did not answer the coursetaking question about a specific course, that student was not included in the analyses for that course. In 2009, the student response rates for the mathematics coursetaking questions ranged from 95 percent to 98 percent. For the science coursetaking questions, the response rates ranged from 94 percent to 98 percent.

Another notable difference between the 2000, 2005, and 2009 NAEP mathematics and science assessments was the way the coursetaking question was asked. In both 2000 and 2005, if the student took a course more than once, the question asked to record the grade level for each instance of the course. As an example, if a student took a two-year algebra I course in both ninth and tenth grades, the student marked both grades on the algebra I course line. In 2009, the coursetaking question was revised to state that the student should only enter the most recent grade level a course was taken. Applying the previous example to the 2009 assessment, a student who took a two-year algebra I course in both ninth and tenth grades would only mark the tenth grade on the algebra I course line. So that trends could be analyzed between the three assessment years, the use of the most recent grade level a course was taken was applied to both the 2000 and 2005 responses.

## Matching Student Responses to Transcript Records

The transcripts collected as part of the HSTS record the courses that students took between ninth and twelfth grades. The information for each course included the course title, the grade level in which the course was taken, the number of credits earned for the course (if any), and the grade received for the course. Each course was assigned a Classification of Secondary School Course (CSCC) code based on the course title and the description

of the course found in the associated school's course catalog. Only the mathematics and science courses found on the transcript that were taken between the ninth and twelfth grades were matched to the student-reported responses. Courses that the students reported taking in or before the eighth grade were not included in the study. Unless taken for high school credit, courses taken before the ninth grade are not usually recorded on a high school transcript.

The analyses presented in this paper use transcripts as the student's official record of high school coursetaking. The assumption is that the courses recorded on the transcript are correct, but there are limitations with this assumption. In the HSTS, both course catalogs and student transcripts were collected from each sampled school. The courses listed in the course catalogs were keyed (i.e., manually entered into the HSTS coding software) and assigned a CSSC code. The courses listed on the student transcripts were keyed and then title-matched to the appropriate course catalog. As part of the HSTS quality control system, all courses from both the catalogs and transcripts were double keyed (i.e., manually entered twice), and any differences found were re-examined and resolved. Codes assigned to catalog courses were fully reviewed by experienced high school course coders in the first month of catalog coding so that erroneous patterns of course coding could be identified and corrected. As coders became more experienced with course coding, the percentage of courses that were reviewed for quality control dropped (50 percent for HSTS 2009). Transcript title matching followed a similar quality control process. These quality control procedures limited, but did not eliminate, keying and coding errors. It is also possible, but not likely, that the transcripts received from the schools contained courses that students did not take.

To validate the student-reported coursework responses, all mathematics and science courses recorded on the transcripts needed to be classified into one or more courses listed as part of the NAEP student questionnaires' coursetaking questions. The CSSC codes assigned to the courses recorded on transcripts were used for this classification. Using the latest version of the CSSC codes used in the 2009 HSTS, there were 91 mathematics CSSC codes and 149 science CSSC codes that were classified into the 13 mathematics courses and 12 science courses listed in the NAEP student questionnaires' coursetaking questions.

The mathematics course classification was based on a previous validity study that focused on the 2000 NAEP and HSTS data (Shettle, Roey, and Perkins 2005). New mathematics CSSC codes introduced into the HSTS in 2005 and 2009 were then classified into the courses listed on the NAEP student questionnaire based on how similar CSSC codes were classified. For the science course classification, its basis was the classification of CSSC codes used to create the highest-level science course taken variable (LEVSC) found in the 2009 HSTS restricted-use student database. Biology, chemistry, and physics courses were then divided into first- and second-year courses using available National Center for Education Statistics (NCES) data, notably the mathematics and science pipeline variables defined in the first follow-up transcript component of the *Education Longitudinal Study of 2002* (Bozick et al. 2006). The mathematics and science classifications were then reviewed by curriculum experts, and revisions were made based on their suggestions. Appendix C shows the distribution of the mathematics CSSC codes into the courses listed for the coursetaking question on the NAEP mathematics student questionnaire, while appendix D shows the distribution of the science CSSC codes into the

courses listed for the coursetaking question on the NAEP science student questionnaire.

Matching between the student responses to the coursetaking questions on the NAEP student questionnaires and the categorized HSTS transcript courses occurred in two iterations. First, it was determined if the students correctly identified taking a mathematics or science course during their high school careers (i.e., between ninth and twelfth grades). A match was made if the student responded that he or she had taken a course on the NAEP coursetaking question and the course was recorded on the student's transcript. A match was also made if the student responded that he or she had not taken the course and the course was not recorded on the student's transcript. If a student responded that he or she had taken a course but it was not recorded on the transcript, or a student responded that he or she had not taken a course but it was recorded on the transcript, then a non-match was recorded.

Second, it was determined if the students correctly identified the most recent grade level in which they had taken a course. A match was made if the most recent grade levels taken indicated by the students and their transcripts were the same. If the transcript indicated that the course was most recently taken at a different grade level, or the course was not taken at all, a non-match was recorded. The decision to examine the most recent grade level a course was taken instead of any grade level in which it was taken resulted from the change of the coursetaking questions implemented in the 2009 NAEP student questionnaires and the decision to include the trends in results from 2000 to 2009 in this report.

Because the "Other mathematics courses" and "Other science courses" categories were catch-all

categories for those courses where students could not classify a mathematics or science course they had taken, these categories were not included in the analyses presented in this report. Research was conducted into what students classified as "other mathematics" and "other science" courses by noting at what grade levels students indicated taking those courses and matching them up to the mathematics and science courses recorded for those grade levels on the students' transcripts. This research helped to provide the recommendations listed in this report.

Students who incorrectly report which mathematics and science courses they have taken may do so for a number of reasons. Students may not remember the title of a course, or the course title may not easily fit into the categories listed on the NAEP student questionnaire. It is also possible that the course title does not reflect the content of the course. In the HSTS, where possible, each transcript was coded based on the description of the course listed in the associated school catalog. If the course description does not match the course title, a non-match may occur if the student identifies the course based on the course title. For example, a school catalog description for an "Algebra II Review" course notes that the course is designed to review lessons learned in algebra I and geometry for students who need additional preparation before taking an algebra II course. Students taking this course might indicate they have taken an algebra II course, when their transcript indicated that they have taken a combined algebra I/geometry course.

Students may also remember an advanced lesson from a course, such as a discussion of probability in an algebra I course. This situation could lead a student to overreport his or her coursework if the student equates a lesson as a course on the student questionnaire. The coursetaking

questions on the 2005 and 2009 NAEP student questionnaires warned students not to include topics that were part of larger courses, but no such instruction was given in the 2000 NAEP assessments. Students may also not be motivated to answer the coursetaking question, either leaving it blank or intentionally providing incorrect responses because NAEP is a low-stakes assessment; that is, how the student performs on the NAEP assessment has no effect on whether or not the student graduates. Note that while this report contains findings concerning how well students reported the mathematics and science courses they took in high school, it does not attempt to discern why students would not report their coursework correctly.

Although data from the 2000, 2005, and 2009 NAEP twelfth-grade mathematics and science assessments and the associated NAEP HSTS student transcripts were analyzed, only the results from 2009 were used in the figures of this report. The tables listed in the report include all three years of data, and the text accompanying the tables include notable findings in trend data. Appendixes E and F list the data tables that show the results for 2000, 2005, and 2009 for the analyses presented in this report.

## Variance Estimation

Student estimates based on HSTS were subject to sampling error because they were derived from a sample rather than from the whole population. Sampling error was measured by the sampling variance, which indicates how much the population estimate for a given statistic was likely to change if it had been based on another equivalent sample of individuals drawn in exactly the same manner as the actual sample. Since HSTS uses a complex sample design with two-stage

sampling, unequal selection probabilities, and complex weighting procedures, standard textbook formulas could not be used for estimating variances. Instead, variances were estimated using jackknife replication methods (Krewski and Rao 1981). This estimation involved constructing a number of subsamples (also called “replicates”) from the full sample and computing the statistic of interest for each replicate. Measuring the variability among the replicates leads to an accurate estimate of variance for the full sample.

## Interpreting Statistical Significance

Comparisons over time or between groups are based on statistical tests that consider both the estimated size of the difference and the standard error of that estimated difference. In this report, when comparing two estimates to determine if they are different, statistical *t* tests were performed. No adjustments were made for multiple comparisons. A difference that is large and would appear to be a significant difference may not be statistically significant if the standard error for that difference was also large. Similarly, differences of the same estimated size may be statistically significant in some cases but not in other cases because of the sizes of the standard errors involved.

Unless otherwise noted, only findings that are statistically significant at the .05 level are discussed in this report. An asterisk (\*) is used in the figures and tables of this report to indicate a statistical significance. Based on the figure or table in which it appears, an asterisk may indicate significant differences between the student-reported and transcript-recorded measures. It may also indicate if a percentage or mean from the 2000 or 2005 assessments is significantly different from the 2009 assessment.

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# APPENDIX A

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Mathematics coursetaking question on the  
2009 NAEP twelfth-grade mathematics assessment  
student questionnaire

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# Section 4

VC298762

1. Which courses have you taken from eighth grade to the present? If you have taken a course more than once, give the **most recent** year you took it. Fill in **one** oval on each line. **INCLUDE** courses taken in summer school, but **DO NOT INCLUDE** topics that were only taught as part of a longer course (such as trigonometry taught in drafting class or computer programming taught in Algebra II).

	I have never taken this course	I took this course in or before Grade 8	I took this course in Grade 9	I took this course in Grade 10	I took this course in Grade 11	I took this course in Grade 12	
a. <b>Basic or general mathematics</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC298769
b. <b>Tech-prep mathematics, business mathematics, consumer mathematics, or other applied mathematics</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC298847
c. <b>Introduction to algebra or pre-algebra</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299007
d. <b>Algebra I</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299008
e. <b>Geometry</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299009
f. <b>Algebra II</b> course, with or without trigonometry	(A)	(B)	(C)	(D)	(E)	(F)	VC299010
g. <b>Trigonometry</b> (as a separate course)	(A)	(B)	(C)	(D)	(E)	(F)	VC299012
h. <b>Pre-calculus</b> course (also called third-year algebra or elementary functions and analysis)	(A)	(B)	(C)	(D)	(E)	(F)	VC299013
i. <b>Unified, integrated, or sequential mathematics</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299030
j. <b>Probability or statistics</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299032
k. <b>Calculus</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299033
l. <b>Discrete or finite mathematics</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299035
m. <b>Other mathematics</b> course	(A)	(B)	(C)	(D)	(E)	(F)	VC299036
n. <b>Computer programming</b> course (such as C++, Pascal, Visual Basic, etc.)	(A)	(B)	(C)	(D)	(E)	(F)	VC299037

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# APPENDIX B

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Science coursetaking question on the  
2009 NAEP twelfth-grade science assessment  
student questionnaire

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## SECTION 4

## Section 4

This section has 19 questions. Mark your answers in your booklet. Unless directed otherwise, fill in only **one** oval for each question.

1. Which courses have you taken from eighth grade to the present? If you have taken a course more than once, give the most recent year you took it. Fill in **one** oval on each line. **INCLUDE** courses taken in summer school, but **DO NOT INCLUDE** topics that were only taught as part of a longer course. VC305768
- |   | Course<br>not<br>taken  | I took this<br>course in<br>Grade 8 | I took this<br>course in<br>Grade 9 | I took this<br>course in<br>Grade 10 | I took this<br>course in<br>Grade 11 | I am taking<br>or have<br>taken this<br>course in<br>Grade 12 |          |
|---|-------------------------|-------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|---|----------|
| a. Earth and space science                            | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305813 |
| b. Life science (other than biology)                  | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305814 |
| c. Physical science (other than chemistry or physics) | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305815 |
| d. General science                                    | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305817 |
| e. First-year biology                                 | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305819 |
| f. Second-year biology                                | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305820 |
| g. First-year chemistry                               | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305821 |
| h. Second-year chemistry                              | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305822 |
| i. First-year physics                                 | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305823 |
| j. Second-year physics                                | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305825 |
| k. Engineering and technology                         | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305826 |
| l. Other science course                               | <input type="radio"/> A | <input type="radio"/> B             | <input type="radio"/> C             | <input type="radio"/> D              | <input type="radio"/> E              | <input type="radio"/> F                                       | VC305829 |

# APPENDIX C

Mapping of CSSC mathematics course codes to the mathematics courses listed on the NAEP twelfth-grade mathematics assessment's coursetaking question

**CSSC Code**      **Course Title**

## **BASIC OR GENERAL MATHEMATICS**

270100	MATHEMATICS, OTHER GENERAL
270101	MATHEMATICS 7 - MIDDLE SCHOOL LEVEL
270102	MATHEMATICS 7, ACCELERATED - MIDDLE SCHOOL LEVEL
270103	MATHEMATICS 8 - MIDDLE SCHOOL LEVEL
270105	MATHEMATICS, BASIC (RETIRED CODE)
270106	MATHEMATICS 1, GENERAL
270107	MATHEMATICS 2, GENERAL
270601	BASIC MATH 1
270602	BASIC MATH 2
270603	BASIC MATH 3
270604	BASIC MATH 4
541001	GENERAL MATH SKILLS
541009	FUNCTIONAL MATH SKILLS, NOT FOR CREDIT
562700	SPECIAL EDUCATION MATH
562701	RESOURCE GENERAL MATH
562709	RESOURCE GENERAL MATH, NOT FOR CREDIT

## **TECH-PREP, BUSINESS, CONSUMER, OR APPLIED MATHEMATICS**

010151	AGRICULTURAL MATHEMATICS
070171	BUSINESS MATHEMATICS 1
070172	BUSINESS MATHEMATICS 2
110121	COMPUTER MATHEMATICS 1

**CSSC Code**      **Course Title**

## **TECH-PREP, BUSINESS, CONSUMER, OR APPLIED MATHEMATICS (CONT.)**

110122	COMPUTER MATHEMATICS 2
270108	SCIENCE MATHEMATICS
270109	MATHEMATICS IN THE ARTS
270110	MATHEMATICS, VOCATIONAL
270111	TECHNICAL MATHEMATICS
270114	CONSUMER MATHEMATICS
270200	ACTUARIAL SCIENCES, OTHER
270300	APPLIED MATHEMATICS, OTHER
320108	MATHEMATICS, VOCATIONAL (CHANGED TO 270110)
541101	FUNCTIONAL CONSUMER MATH
541109	FUNCTIONAL CONSUMER MATH, NOT FOR CREDIT
541201	FUNCTIONAL VOCATIONAL MATH
541209	FUNCTIONAL VOCATIONAL MATH, NOT FOR CREDIT
562711	RESOURCE VOCATIONAL MATH
562719	RESOURCE VOCATIONAL MATH, NOT FOR CREDIT
562721	RESOURCE CONSUMER MATH
562729	RESOURCE CONSUMER MATH, NOT FOR CREDIT

## **INTRODUCTION TO ALGEBRA OR PRE-ALGEBRA**

270104	MATHEMATICS 8, ACCELERATED - MIDDLE SCHOOL LEVEL
270401	PRE-ALGEBRA

## **ALGEBRA I**

270402	ALGEBRA 1, PART 1
270403	ALGEBRA 1, PART 2
270404	ALGEBRA 1
270438	ALGEBRA AND GEOMETRY
270439	ALGEBRA REVIEW

CSSC Code	Course Title
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### GEOMETRY

270406	GEOMETRY, PLANE
270407	GEOMETRY, SOLID
270408	GEOMETRY
270409	GEOMETRY, INFORMAL
270412	ANALYTIC GEOMETRY
270425	GEOMETRY, PART 1
270426	GEOMETRY, PART 2
270429	PRE-IB GEOMETRY (RETIRED CODE)
270438	ALGEBRA AND GEOMETRY
270439	ALGEBRA REVIEW

### ALGEBRA II, WITH OR WITHOUT TRIGONOMETRY

270405	ALGEBRA 2
270414	ALGEBRA AND TRIGONOMETRY
270415	ALGEBRA AND ANALYTIC GEOMETRY
270430	PRE-IB ALGEBRA 2/TRIGONOMETRY (RETIRED CODE)

### TRIGONOMETRY (AS A SEPARATE COURSE)

270411	TRIGONOMETRY
270413	TRIGONOMETRY AND SOLID GEOMETRY
270442	FUNCTION, STATISTICS, AND TRIGONOMETRY

### PRE-CALCULUS (INCLUDING THIRD-YEAR ALGEBRA AND ELEMENTARY FUNCTIONS AND ANALYSIS)

270410	ALGEBRA 3
270416	ANALYSIS, INTRODUCTORY
270417	LINEAR ALGEBRA
270432	IB MATH STUDIES 1
270433	IB MATH STUDIES 2
270442	FUNCTION, STATISTICS, AND TRIGONOMETRY
270443	ADVANCED FUNCTIONS AND MODELING

CSSC Code	Course Title
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### UNIFIED, INTEGRATED, OR SEQUENTIAL MATHEMATICS

270421	MATHEMATICS 1, UNIFIED
270422	MATHEMATICS 2, UNIFIED
270423	MATHEMATICS 3, UNIFIED
270427	UNIFIED MATH 1, PART 1
270428	UNIFIED MATH 1, PART 2

### PROBABILITY OR STATISTICS

270442	FUNCTION, STATISTICS, AND TRIGONOMETRY
270500	STATISTICS, OTHER
270511	STATISTICS
270521	PROBABILITY
270531	PROBABILITY AND STATISTICS
270532	AP STATISTICS

### CALCULUS

270418	CALCULUS AND ANALYTIC GEOMETRY
270419	CALCULUS
270420	AP CALCULUS AB
270434	IB MATH STUDIES/CALCULUS
270435	AP CALCULUS BC

### DISCRETE OR FINITE MATHEMATICS

270436	DISCRETE MATH
270437	FINITE MATH

### OTHER MATHEMATICS COURSES

270112	MATHEMATICS REVIEW
270113	MATHEMATICS TUTORING
270400	PURE MATHEMATICS, OTHER
270424	MATHEMATICS, INDEPENDENT STUDY
270431	IB MATH METHODS 1
270440	IB FURTHER MATHEMATICS STANDARD (SL)
270441	IB MATHEMATICS HIGHER (HL)
279900	MATHEMATICS, OTHER

# APPENDIX D

Mapping of CSSC science course codes to the science courses listed on the NAEP twelfth-grade science assessment's coursetaking question

**CSSC  
Code**      **Course Title**

## EARTH AND SPACE SCIENCE

300623	IB ENVIRONMENTAL STUDIES
400200	ASTRONOMY, OTHER
400211	ASTRONOMY
400300	ASTROPHYSICS, OTHER
400400	ATMOSPHERIC SCIENCES AND METEOROLOGY, OTHER
400411	METEOROLOGY
400600	GEOLOGICAL SCIENCES, OTHER
400611	EARTH SCIENCE
400621	EARTH SCIENCE, COLLEGE PREPARATORY
400631	GEOLOGY
400632	GEOLOGY - FIELD STUDIES
400641	MINERALOGY
400711	OCEANOGRAPHY
400900	PLANETARY SCIENCE, OTHER
400911	ROCKETRY AND SPACE SCIENCE
401000	AEROSPACE SCIENCE, OTHER
401011	AEROSPACE SCIENCE

## LIFE SCIENCE (OTHER THAN BIOLOGY)

260111	SCIENCE 7
260600	MISCELLANEOUS SPECIALIZED AREAS, LIFE SCIENCES, OTHER
260611	ECOLOGY
269900	LIFE SCIENCES, OTHER
400622	AP ENVIRONMENTAL SCIENCE

**CSSC  
Code**      **Course Title**

## PHYSICAL SCIENCE (OTHER THAN CHEMISTRY OR PHYSICS)

400100	PHYSICAL SCIENCES, OTHER GENERAL
400111	SCIENCE 8
400121	PHYSICAL SCIENCE
400131	CHEMISTRY AND PHYSICS LABORATORY TECHNIQUES
400141	PHYSICAL SCIENCE, APPLIED
400700	MISCELLANEOUS PHYSICAL SCIENCES, OTHER
409900	PHYSICAL SCIENCES, OTHER

## GENERAL SCIENCE

300111	SCIENCE, UNIFIED
300112	COLLEGE-PREP SCIENCE SKILLS
300113	SCIENCE, UNIFIED, ADVANCED
544001	FUNCTIONAL SCIENCE
544009	FUNCTIONAL SCIENCE, NOT FOR CREDIT
564000	SPECIAL EDUCATION GENERAL SCIENCE
564001	RESOURCE GENERAL SCIENCE
564009	RESOURCE GENERAL SCIENCE, NOT FOR CREDIT

## FIRST-YEAR BIOLOGY

260100	BIOLOGY, OTHER GENERAL
260121	BIOLOGY, BASIC 1
260131	BIOLOGY, GENERAL 1
260141	BIOLOGY, HONORS 1
260143	PRE-IB BIOLOGY (RETIRED CODE)
260311	BOTANY
260621	MARINE BIOLOGY
260711	ZOOLOGY

## SECOND-YEAR BIOLOGY

260122	BIOLOGY, BASIC 2
260132	BIOLOGY, GENERAL 2
260142	BIOLOGY, ADVANCED
260144	IB BIOLOGY 2
260145	IB BIOLOGY 3

**CSSC  
Code**

**Course Title**

**SECOND-YEAR BIOLOGY (CONT.)**

260146	AP BIOLOGY
260151	FIELD BIOLOGY
260161	GENETICS
260171	BIOPSYCHOLOGY
260181	BIOLOGY SEMINAR
260200	BIOCHEMISTRY AND BIOPHYSICS, OTHER
260211	BIOCHEMISTRY
260300	BOTANY, OTHER
260400	CELL AND MOLECULAR BIOLOGY, OTHER
260411	CELL BIOLOGY
260500	MICROBIOLOGY, OTHER
260511	MICROBIOLOGY
260622	MARINE BIOLOGY, ADVANCED
260631	ANATOMY
260700	ZOOLOGY, OTHER
260721	ZOOLOGY, VERTEBRATE
260731	ZOOLOGY, INVERTEBRATE
260741	ANIMAL BEHAVIOR
260751	PHYSIOLOGY, HUMAN
260752	PHYSIOLOGY, ADVANCED
260761	PATHOLOGY
260771	COMPARATIVE EMBRYOLOGY
260781	ENTOMOLOGY
260791	ORNITHOLOGY

**FIRST-YEAR CHEMISTRY**

400511	CHEMISTRY, INTRODUCTORY
400512	CHEMISTRY IN THE COMMUNITY
400521	CHEMISTRY 1
400523	PRE-IB CHEMISTRY 1 (RETIRED CODE)
400531	ORGANIC CHEMISTRY
400541	PHYSICAL CHEMISTRY
400551	CONSUMER CHEMISTRY

**CSSC  
Code**

**Course Title**

**SECOND-YEAR CHEMISTRY**

400500	CHEMISTRY, OTHER
400522	CHEMISTRY 2
400524	IB CHEMISTRY 2
400525	IB CHEMISTRY 3
400526	AP CHEMISTRY
400561	CHEMISTRY, INDEPENDENT STUDY

**FIRST-YEAR PHYSICS**

400811	PHYSICS, GENERAL
400821	PHYSICS 1

**SECOND-YEAR PHYSICS**

400800	PHYSICS, OTHER
400822	PHYSICS 2
400823	IB PHYSICS
400824	AP PHYSICS B
400825	AP PHYSICS C: MECHANICS
400826	AP PHYSICS C: ELECTRICITY/MAGNETISM
400831	PHYSICS 2 WITHOUT CALCULUS
410211	RADIOACTIVITY

**ENGINEERING AND TECHNOLOGY**

140100	ENGINEERING, OTHER GENERAL
140111	ORIENTATION TO ENGINEERING
140121	INDEPENDENT PROJECT, ENGINEERING
140200	AEROSPACE, AERONAUTICAL, AND ASTRONAUTICAL ENGINEERING, OTHER
140211	AEROSPACE MATERIALS
140221	AEROSPACE ENGINEERING DESIGN
140300	AGRICULTURAL ENGINEERING, OTHER
140400	ARCHITECTURAL ENGINEERING, OTHER
140411	STRENGTH OF MATERIALS - ARCHITECTURAL
140500	BIOENGINEERING AND BIOMEDICAL ENGINEERING, OTHER
140600	CERAMIC ENGINEERING, OTHER

CSSC Code	Course Title
<b>ENGINEERING AND TECHNOLOGY (CONT.)</b>	
140700	CHEMICAL ENGINEERING, OTHER
140800	CIVIL ENGINEERING, OTHER
140900	COMPUTER ENGINEERING, OTHER
140911	ROBOTICS
141000	ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING, OTHER
141100	ENGINEERING MECHANICS, OTHER
141200	ENGINEERING RELATED, OTHER
141211	INSTRUMENTATION PHYSICS 1
141212	INSTRUMENTATION PHYSICS 2
141213	INSTRUMENTATION PHYSICS 3
141214	INSTRUMENTATION PHYSICS 4
141300	ENGINEERING SCIENCE, OTHER
141400	ENVIRONMENTAL HEALTH ENGINEERING, OTHER
141500	GEOLOGICAL ENGINEERING, OTHER
141600	GEOPHYSICAL ENGINEERING, OTHER
141700	INDUSTRIAL ENGINEERING, OTHER
141800	MATERIALS ENGINEERING, OTHER
141900	MECHANICAL ENGINEERING, OTHER
141911	STRENGTH OF MATERIALS, MECHANICAL TECHNOLOGY
142000	METALLURGICAL ENGINEERING, OTHER
142011	METALLURGY/POWDER METAL BASICS
142100	MINING AND MINERAL ENGINEERING, OTHER
142200	NAVAL ARCHITECTURE AND MARINE ENGINEERING, OTHER
142300	NUCLEAR ENGINEERING, OTHER
142400	OCEAN ENGINEERING, OTHER
142500	PETROLEUM ENGINEERING, OTHER
142600	SURVEYING AND MAPPING SCIENCES, OTHER
142611	CARTOGRAPHY
142700	SYSTEMS ENGINEERING, OTHER
142800	TEXTILE ENGINEERING, OTHER

CSSC Code	Course Title
<b>ENGINEERING AND TECHNOLOGY (CONT.)</b>	
149900	ENGINEERING, OTHER
300300	ENGINEERING AND OTHER DISCIPLINES, OTHER
300311	ENGINEERING CONCEPTS
300321	IB DESIGN TECHNOLOGY, STANDARD (SL)
300322	IB DESIGN TECHNOLOGY, HIGHER (HL)
400812	PRINCIPLES OF TECHNOLOGY 1
400813	PRINCIPLES OF TECHNOLOGY 2
400841	ELECTRICITY AND ELECTRONICS SCIENCE
400851	ACOUSTICS
<b>OTHER SCIENCE COURSES</b>	
300100	BIOLOGICAL AND PHYSICAL SCIENCES, OTHER
300121	SCIENCE STUDY, INDEPENDENT

# APPENDIX E

## Student-reported and transcript-recorded mathematics coursetaking data tables

**TABLE E1.** Comparison of student-reported and transcript-recorded percentages of high school students taking mathematics courses: 2000, 2005, and 2009

Mathematics course	Percentage of high school students taking mathematics course																	
	2000						2005						2009					
	Student-reported	Transcript-recorded		Difference			Student-reported	Transcript-recorded		Difference			Student-reported	Transcript-recorded		Difference		
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Basic/general mathematics	11.0	0.66	15.2	1.17	<b>4.2</b>	0.98	19.3	0.72	11.1	0.79	<b>-8.3</b>	1.03	17.9	0.47	9.4	0.48	<b>-8.5</b>	0.60
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	24.8	1.07	12.4	1.08	<b>-12.4</b>	0.94	26.1	0.71	10.0	0.80	<b>-16.2</b>	0.84	26.0	0.52	9.9	0.75	<b>-16.2</b>	0.68
Introduction to algebra/pre-algebra	30.3	1.12	11.4	1.19	<b>-18.9</b>	1.05	29.9	0.83	8.9	0.64	<b>-21.0</b>	0.86	25.4	0.53	5.8	0.46	<b>-19.6</b>	0.67
Algebra I	70.3	1.33	70.3	1.87	0.0	1.77	70.1	0.83	69.4	1.07	-0.7	0.80	66.7	0.78	64.6	1.08	<b>-2.1</b>	0.88
Geometry	87.3	0.70	80.5	1.90	<b>-6.7</b>	1.54	89.0	0.57	84.5	0.99	<b>-4.5</b>	0.77	89.7	0.56	85.5	1.21	<b>-4.2</b>	0.76
Algebra II, with or without trigonometry	81.5	0.68	75.0	1.86	<b>-6.6</b>	1.61	81.5	0.57	74.1	1.14	<b>-7.4</b>	0.85	85.8	0.51	79.4	0.98	<b>-6.4</b>	0.84
Trigonometry (as a separate course)	26.7	1.77	9.8	1.74	<b>-16.9</b>	1.51	23.8	1.14	8.9	0.93	<b>-14.9</b>	0.89	23.9	1.05	9.6	1.01	<b>-14.3</b>	0.91
Precalculus/third-year algebra/elementary functions and analysis	40.2	1.51	34.6	1.78	<b>-5.6</b>	1.36	39.4	1.14	38.4	1.29	-0.9	0.95	43.8	0.76	46.0	0.87	<b>2.2</b>	0.60
Unified/integrated/sequential mathematics	9.5	1.20	11.2	1.98	1.7	1.11	9.2	0.68	15.3	1.11	<b>6.0</b>	0.94	9.2	0.50	10.2	1.24	1.0	1.08
Probability/statistics	17.1	1.15	6.6	0.95	<b>-10.5</b>	0.82	15.8	0.69	8.8	0.74	<b>-6.9</b>	0.54	18.6	0.57	14.1	0.87	<b>-4.5</b>	0.53
Calculus	18.1	0.92	15.7	1.03	<b>-2.3</b>	0.46	19.2	0.61	17.0	0.64	<b>-2.2</b>	0.24	20.2	0.73	18.6	0.77	<b>-1.6</b>	0.25
Discrete/finite mathematics	4.3	0.43	0.7	0.24	<b>-3.6</b>	0.38	4.0	0.34	1.7	0.29	<b>-2.4</b>	0.23	5.4	0.42	2.4	0.35	<b>-2.9</b>	0.29
Other mathematics	16.2	0.77	2.5	0.40	<b>-13.8</b>	0.81	17.2	0.83	4.5	0.72	<b>-12.7</b>	1.08	17.2	0.59	5.1	0.44	<b>-12.1</b>	0.76

<sup>1</sup>Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

NOTE: The abbreviation "s.e." stands for standard error. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E2. Percentage distribution of high school students by their self-reported and transcript-recorded mathematics coursetaking: 2000, 2005, and 2009**

Mathematics course	Percentage of high school graduates who																							
	Correctly reported taking mathematics course found on their transcripts						Reported taking mathematics course not found on their transcripts						Did not report taking mathematics course found on their transcript						Correctly reported not taking mathematics course not found on their transcripts					
	2000		2005		2009		2000		2005		2009		2000		2005		2009		2000		2005		2009	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Basic/general mathematics	4.7	0.48	<b>4.6</b>	0.38	3.7	0.20	<b>6.3</b>	0.48	14.7	0.68	14.2	0.42	<b>10.6</b>	0.91	6.4	0.64	5.7	0.36	78.4	1.29	<b>74.2</b>	0.89	76.4	0.59
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	<b>8.9</b>	0.89	6.2	0.59	6.1	0.46	<b>15.9</b>	0.76	20.0	0.65	20.0	0.47	3.5	0.45	3.8	0.37	3.8	0.37	71.7	1.19	70.0	0.80	70.2	0.71
Introduction to algebra/pre-algebra	<b>9.6</b>	1.07	<b>7.1</b>	0.54	4.3	0.34	20.8	1.00	22.7	0.80	21.1	0.61	1.9	0.23	1.8	0.22	1.5	0.18	<b>67.8</b>	1.22	<b>68.4</b>	0.86	73.1	0.56
Algebra I	61.0	1.86	<b>62.3</b>	1.08	58.6	1.05	9.3	1.27	7.8	0.63	8.2	0.79	<b>9.3</b>	1.04	<b>7.1</b>	0.41	6.1	0.30	<b>20.4</b>	1.18	<b>22.8</b>	0.77	27.2	0.79
Geometry	<b>78.9</b>	1.84	82.6	0.99	83.6	1.19	8.4	1.48	6.3	0.70	6.1	0.73	1.6	0.23	1.8	0.20	1.9	0.14	<b>11.1</b>	0.74	9.2	0.51	8.5	0.57
Algebra II, with or without trigonometry	<b>71.9</b>	1.78	<b>71.9</b>	1.12	77.0	0.96	9.6	1.49	9.6	0.83	8.8	0.78	3.0	0.35	2.2	0.21	2.4	0.18	<b>15.5</b>	0.70	<b>16.3</b>	0.60	11.8	0.50
Trigonometry (as a separate course)	9.0	1.67	8.2	0.84	8.0	0.94	17.7	1.40	15.6	0.84	15.9	0.79	0.8	0.37	<b>0.7</b>	0.18	1.6	0.36	72.5	1.79	75.5	1.19	74.5	1.08
Precalculus/third-year algebra/elementary functions and analysis	<b>30.5</b>	1.84	<b>32.4</b>	1.27	38.6	0.83	<b>9.7</b>	1.07	<b>6.9</b>	0.69	5.2	0.37	<b>4.1</b>	0.72	6.0	0.63	7.4	0.45	<b>55.7</b>	1.37	<b>54.6</b>	1.14	48.8	0.80
Unified/integrated/sequential mathematics	4.8	1.21	4.6	0.63	3.5	0.41	4.8	0.41	<b>4.7</b>	0.35	5.7	0.28	6.5	1.02	<b>10.7</b>	0.83	6.8	0.99	84.0	1.97	<b>80.1</b>	1.11	84.0	1.23
Probability/statistics	<b>6.3</b>	0.92	<b>8.4</b>	0.68	12.5	0.63	<b>10.8</b>	0.80	<b>7.3</b>	0.49	6.1	0.33	<b>0.2</b>	0.08	<b>0.4</b>	0.20	1.7	0.37	<b>82.7</b>	1.16	<b>83.8</b>	0.73	79.7	0.80
Calculus	<b>15.0</b>	0.99	16.4	0.61	17.9	0.74	3.1	0.43	2.7	0.23	2.3	0.13	0.7	0.25	0.5	0.14	0.7	0.18	81.2	0.98	80.3	0.65	79.1	0.75
Discrete/finite mathematics	<b>0.7</b>	0.24	1.3	0.29	2.1	0.33	3.6	0.38	2.7	0.22	3.2	0.27	#	#	0.4	0.11	0.3	0.12	<b>95.7</b>	0.43	<b>95.6</b>	0.36	94.4	0.44
Other mathematics course	<b>0.6</b>	0.18	1.4	0.26	1.9	0.20	15.6	0.77	15.8	0.81	15.3	0.63	<b>1.9</b>	0.28	3.1	0.55	3.2	0.30	<b>81.9</b>	0.86	79.7	0.97	79.6	0.64

# Rounds to zero.

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

NOTE: The abbreviation “s.e.” stands for standard error. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.



**TABLE E3.** Percentage of high school students who reported taking mathematics courses that were recorded on their transcripts: 2000, 2005, and 2009

Mathematics course student reported taking	2000				2005				2009			
	Course recorded on student transcript		Course not recorded on student transcript		Course recorded on student transcript		Course not recorded on student transcript		Course recorded on student transcript		Course not recorded on student transcript	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Basic/general mathematics	<b>42.6</b>	3.16	57.4	3.16	23.9	1.84	76.1	1.84	20.9	1.01	79.1	1.01
Tech-prep/business/ consumer/applied mathematics <sup>1</sup>	<b>35.8</b>	2.72	64.2	2.72	23.5	2.00	76.5	2.00	23.3	1.58	76.7	1.58
Introduction to algebra/ pre-algebra	<b>31.5</b>	3.01	68.5	3.01	<b>23.9</b>	1.68	76.1	1.68	17.0	1.37	83.0	1.37
Algebra I	86.8	1.83	13.2	1.83	88.9	0.92	11.1	0.92	87.8	1.18	12.2	1.18
Geometry	90.4	1.72	9.6	1.72	92.9	0.80	7.1	0.80	93.2	0.85	6.8	0.85
Algebra II, with or without trigonometry	88.2	1.85	11.8	1.85	88.2	1.04	11.8	1.04	89.7	0.92	10.3	0.92
Trigonometry (as a separate course)	33.7	5.04	66.3	5.04	34.6	2.67	65.4	2.67	33.6	3.10	66.4	3.10
Precalculus/third-year algebra/elementary functions and analysis	<b>75.9</b>	2.80	24.1	2.80	<b>82.3</b>	1.77	17.7	1.77	88.1	0.86	11.9	0.86
Unified/integrated/ sequential mathematics	49.9	6.98	50.1	6.98	<b>49.6</b>	4.18	50.4	4.18	37.8	3.00	62.2	3.00
Probability/statistics	<b>37.0</b>	4.04	63.0	4.04	<b>53.4</b>	3.02	46.6	3.02	67.0	1.95	33.0	1.95
Calculus	<b>83.1</b>	2.44	16.9	2.44	<b>85.7</b>	1.22	14.3	1.22	88.6	0.74	11.4	0.74
Discrete/finite mathematics	<b>16.5</b>	4.94	83.5	4.94	32.5	5.18	67.5	5.18	39.8	4.21	60.2	4.21
Other mathematics	<b>3.8</b>	1.08	96.2	1.08	8.3	1.46	91.7	1.46	11.0	1.21	89.0	1.21

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

NOTE: The abbreviation “s.e.” stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E4.** Percentage of high school students' transcripts where the recorded mathematics courses were reported by students: 2000, 2005, and 2009

Mathematics course recorded on student transcript	2000				2005				2009			
	Student reported taking course		Student did not report taking course		Student reported taking course		Student did not report taking course		Student reported taking course		Student did not report taking course	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Basic/general mathematics	<b>30.7</b>	2.29	69.3	2.29	41.9	2.91	58.1	2.91	38.8	1.60	61.2	1.60
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	<b>71.5</b>	2.95	28.5	2.95	61.6	2.57	38.4	2.57	61.2	1.93	38.8	1.93
Introduction to algebra/pre-algebra	<b>83.7</b>	1.64	16.3	1.64	<b>80.2</b>	2.04	19.8	2.04	73.9	2.06	26.1	2.06
Algebra I	<b>86.8</b>	1.42	13.2	1.42	89.7	0.59	10.3	0.59	90.5	0.46	9.5	0.46
Geometry	98.0	0.27	2.0	0.27	97.8	0.24	2.2	0.24	97.8	0.16	2.2	0.16
Algebra II, with or without trigonometry	<b>96.0</b>	0.45	4.0	0.45	97.0	0.29	3.0	0.29	97.0	0.23	3.0	0.23
Trigonometry (as a separate course)	91.8	3.60	8.2	3.60	<b>92.2</b>	1.67	7.8	1.67	83.3	3.50	16.7	3.50
Precalculus/third-year algebra/elementary functions and analysis	88.2	2.09	11.8	2.09	84.4	1.58	15.6	1.58	83.9	0.92	16.1	0.92
Unified/integrated/sequential mathematics	42.3	4.97	57.7	4.97	30.0	3.17	70.0	3.17	32.9	3.12	67.1	3.12
Probability/statistics	<b>96.4</b>	1.25	3.6	1.25	<b>95.5</b>	2.17	4.5	2.17	88.2	2.13	11.8	2.13
Calculus	95.3	1.58	4.7	1.58	96.8	0.77	3.2	0.77	96.1	0.92	3.9	0.92
Discrete/finite mathematics	<b>100.0</b>	#	#	#	78.8	6.67	21.2	6.67	88.3	4.61	11.7	4.61
Other mathematics	<b>24.7</b>	4.70	75.3	4.70	31.9	3.73	68.1	3.73	36.5	2.10	63.5	2.10

# Rounds to zero.

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

NOTE: The abbreviation "s.e." stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E5.** Percentage of high school students' transcripts where the recorded mathematics courses were reported by students, by the reported most recent grade level taken: 2000, 2005, and 2009

Mathematics course recorded on student transcript and reported by student	2000				2005				2009			
	Student and transcript agree on most recent grade level taken		Student and transcript disagree on most recent grade level taken		Student and transcript agree on most recent grade level taken		Student and transcript disagree on most recent grade level taken		Student and transcript agree on most recent grade level taken		Student and transcript disagree on most recent grade level taken	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Basic/general mathematics	38.5	3.41	61.5	3.41	38.3	3.30	61.7	3.30	37.3	2.34	62.7	2.34
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	68.2	3.27	31.8	3.27	62.1	2.73	37.9	2.73	64.3	1.85	35.7	1.85
Introduction to algebra/pre-algebra	<b>77.4</b>	2.82	22.6	2.82	69.9	2.61	30.1	2.61	69.2	2.41	30.8	2.41
Algebra I	79.1	1.45	20.9	1.45	77.8	0.97	22.2	0.97	76.9	0.64	23.1	0.64
Geometry	<b>88.2</b>	1.03	11.8	1.03	85.0	0.84	15.0	0.84	84.7	0.48	15.3	0.48
Algebra II, with or without trigonometry	81.2	1.39	18.8	1.39	84.0	0.97	16.0	0.97	83.2	0.99	16.8	0.99
Trigonometry (as a separate course)	95.4	1.33	4.6	1.33	96.3	0.82	3.7	0.82	93.9	0.90	6.1	0.90
Precalculus/third-year algebra/elementary functions and analysis	93.2	0.99	6.8	0.99	93.2	0.71	6.8	0.71	93.3	0.73	6.7	0.73
Unified/integrated/sequential mathematics	58.7	4.52	41.3	4.52	57.7	4.96	42.3	4.96	50.6	3.19	49.4	3.19
Probability/statistics	<b>99.0</b>	0.51	1.0	0.51	98.3	0.54	1.7	0.54	97.6	0.32	2.4	0.32
Calculus	96.2	1.14	3.8	1.14	97.5	0.70	2.5	0.70	95.1	1.03	4.9	1.03
Discrete/finite mathematics	95.0	3.81	5.0	3.81	97.5	1.53	2.5	1.53	98.1	1.01	1.9	1.01
Other mathematics	82.7	5.99	17.3	5.99	<b>58.3</b>	6.77	41.7	6.77	77.5	2.96	22.5	2.96

<sup>1</sup> Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

NOTE: The abbreviation "s.e." stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E6.** Percentage distribution of overall number of differences between student-reported and transcript-recorded mathematics courses taken: 2000, 2005, and 2009

Differences	Mathematics					
	2000		2005		2009	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
0	<b>34.1</b>	1.40	27.8	0.85	29.9	0.85
1	25.0	0.92	24.5	0.61	25.0	0.46
2	19.1	0.70	<b>22.3</b>	0.57	19.5	0.46
3	<b>10.3</b>	0.51	12.5	0.45	12.0	0.39
4	<b>5.0</b>	0.50	6.3	0.32	6.4	0.27
5 or more	6.5	0.80	6.7	0.59	7.3	0.62

NOTE: The abbreviation “s.e.” stands for standard error. A difference between student-reported and transcript-recorded courses occurs when a student either reports a course not recorded on his or her transcript or did not report taking a course recorded on his or her transcript. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E7.** Highest-level mathematics course taken by high school students, based on student-reported and transcript-recorded data: 2000, 2005, and 2009

Highest-level mathematics course taken	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Below algebra I	4.3	0.31	2.5	0.44	<b>-1.8</b>	0.45	2.5	0.26	1.8	0.18	<b>-0.6</b>	0.26	1.1	0.14	0.9	0.09	-0.2	0.17
Algebra I	4.7	0.40	5.2	0.54	0.5	0.39	3.0	0.26	3.3	0.26	0.3	0.24	1.9	0.15	2.1	0.19	0.2	0.14
Geometry	9.3	0.56	8.7	0.53	-0.6	0.45	9.4	0.41	9.3	0.46	-0.1	0.38	7.2	0.30	8.1	0.40	<b>0.9</b>	0.29
Algebra II	28.6	0.90	40.3	1.44	<b>11.7</b>	1.06	28.8	0.74	37.4	1.05	<b>8.6</b>	0.84	27.4	0.61	32.2	0.83	<b>4.7</b>	0.68
Advanced mathematics	36.2	0.96	29.1	1.31	<b>-7.1</b>	1.05	36.1	0.74	31.8	0.98	<b>-4.4</b>	0.81	40.7	0.65	38.2	0.81	<b>-2.5</b>	0.60
Calculus	16.8	0.82	14.2	0.94	<b>-2.6</b>	0.45	20.2	0.58	16.4	0.59	<b>-3.8</b>	0.33	21.6	0.70	18.5	0.76	<b>-3.1</b>	0.27

NOTE: The abbreviation “s.e.” stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared. Advanced mathematics includes courses, other than calculus, that are generally taken after algebra II (e.g., AP statistics, trigonometry, precalculus).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E8. Percentage distribution of high school students across the most recent grade levels selected mathematics courses were taken, based on student-reported and transcript-recorded data: 2000, 2005, and 2009**

Mathematics course		Data Source		2000												2005												2009											
				Did not take course		Most recently took in ninth grade		Most recently took in tenth grade		Most recently took in eleventh grade		Most recently took in twelfth grade		Did not take course		Most recently took in ninth grade		Most recently took in tenth grade		Most recently took in eleventh grade		Most recently took in twelfth grade		Did not take course		Most recently took in ninth grade		Most recently took in tenth grade		Most recently took in eleventh grade		Most recently took in twelfth grade							
				Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.						
Basic/general mathematics	Student	89.0	0.66	5.0	0.43	1.6	0.21	2.0	0.29	2.5	0.26	80.7	0.72	6.7	0.44	2.1	0.20	4.6	0.26	5.9	0.31	82.8	0.46	6.8	0.27	1.8	0.12	3.8	0.20	4.8	0.17								
	Transcript	84.8	1.17	4.8	0.40	3.4	0.45	3.4	0.54	3.7	0.59	88.9	0.79	3.7	0.45	2.5	0.32	2.2	0.27	2.7	0.35	90.7	0.47	3.2	0.31	2.1	0.24	1.9	0.18	2.2	0.22								
	Difference	4.2	0.98	0.1	0.52	-1.8	0.44	-1.4	0.55	-1.2	0.59	-8.3	1.03	3.0	0.61	-0.4	0.38	2.4	0.35	3.2	0.46	-7.9	0.60	3.7	0.42	-0.2	0.23	1.9	0.26	2.6	0.29								
Tech-prep/business/consumer/applied mathematics¹	Student	75.2	1.07	6.7	0.53	4.0	0.37	5.5	0.47	8.5	0.70	73.9	0.71	7.6	0.39	5.1	0.28	4.8	0.32	8.7	0.46	74.3	0.52	7.2	0.27	4.7	0.19	5.3	0.20	8.6	0.34								
	Transcript	87.6	1.08	1.3	0.31	2.2	0.41	3.8	0.43	5.1	0.64	90.0	0.80	1.0	0.23	1.3	0.22	2.3	0.28	5.4	0.60	90.2	0.74	0.6	0.11	0.9	0.13	2.9	0.32	5.4	0.50								
	Difference	-12.4	0.94	5.4	0.54	1.8	0.40	1.7	0.39	3.4	0.77	-16.2	0.84	6.6	0.43	3.8	0.36	2.6	0.39	3.3	0.51	-15.9	0.69	6.6	0.27	3.8	0.22	2.4	0.26	3.1	0.42								
Introduction to algebra/pre-algebra	Student	69.7	1.12	22.2	1.04	5.4	0.45	1.9	0.24	0.8	0.14	70.1	0.83	20.1	0.65	5.7	0.31	3.0	0.22	1.1	0.17	75.0	0.53	18.1	0.41	4.2	0.18	2.0	0.13	0.7	0.08								
	Transcript	88.6	1.19	9.1	1.30	1.3	0.18	0.7	0.19	0.3	0.10	91.1	0.64	6.4	0.46	1.3	0.21	0.8	0.13	0.4	0.10	94.2	0.45	4.0	0.31	1.1	0.17	0.5	0.10	0.2	0.05								
	Difference	-18.9	1.05	13.1	0.96	4.1	0.44	1.3	0.26	0.5	0.15	-21.0	0.86	13.7	0.69	4.4	0.37	2.3	0.23	0.7	0.20	-19.2	0.67	14.2	0.49	3.1	0.22	1.4	0.15	0.4	0.09								
Algebra I	Student	29.7	1.33	50.6	1.67	15.1	1.08	3.5	0.34	1.1	0.20	29.9	0.83	49.8	0.83	14.6	0.52	4.4	0.32	1.2	0.17	33.6	0.78	50.6	0.76	11.6	0.39	3.4	0.15	0.8	0.09								
	Transcript	29.7	1.87	46.6	2.15	15.2	1.05	5.7	0.41	2.9	0.43	30.6	1.07	46.5	0.96	14.1	0.65	6.2	0.45	2.6	0.24	35.6	1.09	46.5	0.89	10.9	0.41	4.5	0.30	2.5	0.20								
	Difference	#	1.77	4.0	1.53	#	0.85	-2.1	0.41	-1.8	0.42	-0.7	0.80	3.3	0.77	0.6	0.60	-1.8	0.45	-1.4	0.27	-2.0	0.88	4.1	0.66	0.7	0.41	-1.1	0.32	-1.7	0.22								
Geometry	Student	12.7	0.70	21.6	1.28	44.2	1.63	16.6	0.93	5.0	0.37	11.0	0.57	22.6	0.85	46.2	0.92	15.7	0.79	4.5	0.34	10.4	0.57	26.8	0.67	47.3	0.79	12.6	0.51	2.9	0.19								
	Transcript	19.5	1.90	18.5	1.30	39.3	2.01	16.2	1.04	6.5	0.54	15.5	0.99	18.5	0.85	42.4	0.97	16.9	0.87	6.6	0.43	14.5	1.21	22.8	0.84	42.8	0.92	14.5	0.60	5.3	0.30								
	Difference	-6.7	1.54	3.1	0.68	4.8	0.87	0.3	0.60	-1.5	0.40	-4.5	0.77	4.1	0.43	3.8	0.61	-1.3	0.65	-2.1	0.29	-4.1	0.76	3.9	0.39	4.5	0.49	-1.9	0.31	-2.5	0.21								
Algebra II, with or without trigonometry	Student	18.5	0.68	5.9	0.57	28.5	1.27	37.5	1.50	9.5	0.71	18.5	0.57	5.4	0.47	28.0	0.91	38.2	0.84	10.0	0.47	14.3	0.52	7.1	0.48	31.0	0.75	38.6	0.75	9.1	0.37								
	Transcript	25.0	1.86	3.1	0.50	22.0	1.35	35.2	1.67	14.6	1.08	25.9	1.14	3.7	0.42	22.5	0.90	34.3	0.84	13.6	0.59	20.6	0.98	4.9	0.40	24.9	0.83	36.4	0.88	13.1	0.57								
	Difference	-6.6	1.61	2.8	0.37	6.5	0.96	2.3	0.86	-5.1	0.78	-7.4	0.85	1.7	0.44	5.4	0.56	3.9	0.64	-3.6	0.47	-6.4	0.84	2.1	0.30	6.1	0.57	2.2	0.74	-4.0	0.47								
Trigonometry (as a separate course)	Student	73.3	1.77	0.3	0.09	3.7	0.61	12.5	1.07	10.1	0.88	76.2	1.14	0.5	0.09	2.6	0.28	11.3	0.74	9.4	0.58	76.2	1.06	0.7	0.08	3.4	0.30	11.4	0.82	8.3	0.41								
	Transcript	90.2	1.74	#	#	1.3	0.58	4.7	0.90	3.9	0.72	91.1	0.93	0.2	0.09	0.5	0.16	4.1	0.54	4.2	0.46	90.3	1.02	0.2	0.12	0.7	0.14	5.1	0.69	3.7	0.42								
	Difference	-16.9	1.51	0.3	0.09	2.5	0.55	7.9	0.72	6.2	0.77	-14.9	0.89	0.3	0.10	2.1	0.29	7.3	0.54	5.2	0.41	-14.1	0.92	0.5	0.16	2.6	0.28	6.3	0.62	4.6	0.42								
Precalculus/third-year algebra/elementary functions and analysis	Student	59.8	1.51	0.5	0.10	2.7	0.53	18.0	1.15	19.0	0.96	60.6	1.14	0.5	0.09	2.7	0.36	19.5	0.77	16.7	0.65	56.3	0.76	0.4	0.05	2.9	0.30	22.5	0.59	18.0	0.55								
	Transcript	65.4	1.78	#	0.03	1.5	0.45	15.4	1.23	17.7	1.09	61.6	1.29	0.3	0.14	2.4	0.33	17.7	0.84	18.1	0.81	54.0	0.86	0.1	0.03	2.3	0.30	21.5	0.58	22.1	0.66								
	Difference	-5.6	1.36	0.4	0.11	1.2	0.33	2.6	0.78	1.3	0.74	-0.9	0.95	0.2	0.16	0.3	0.24	1.8	0.60	-1.4	0.61	2.2	0.60	0.2	0.04	0.6	0.10	1.0	0.39	-4.1	0.53								
Unified/integrated/sequential mathematics	Student	90.5	1.20	1.4	0.24	2.2	0.42	3.7	0.56	2.2	0.24	90.8	0.68	1.3	0.16	1.9	0.24	2.7	0.29	3.3	0.35	91.1	0.49	1.8	0.20	1.6	0.15	2.6	0.17	2.9	0.21								
	Transcript	88.8	1.98	1.2	0.38	2.2	0.57	5.0	1.17	2.9	0.59	84.7	1.11	2.0	0.33	3.6	0.44	5.3	0.54	4.3	0.44	89.9	1.24	0.9	0.15	3.2	0.65	4.0	0.52	2.0	0.36								
	Difference	1.7	1.11	0.2	0.38	#	0.40	-1.3	0.78	-0.7	0.55	6.0	0.94	-0.7	0.32	-1.7	0.43	-2.5	0.46	-1.1	0.45	1.2	1.09	0.9	0.14	-1.6	0.60	-1.4	0.47	0.9	0.35								
Probability/statistics	Student	82.9	1.15	1.9	0.26	2.4	0.40	4.8	0.43	8.0	0.74	84.2	0.69	0.9	0.13	1.2	0.17	3.5	0.30	10.1	0.58	81.7	0.57	1.2	0.10	1.7	0.14	3.9	0.32	11.6	0.49								
	Transcript	93.4	0.95	#	0.02	0.2	0.11	0.8	0.26	5.5	0.77	91.2	0.74	0.1	0.04	0.3	0.17	1.3	0.20	7.2	0.63	85.8	0.86	0.1	0.07	0.5	0.16	3.1	0.44	10.4	0.56								
	Difference	-10.5	0.82	1.9	0.26	2.2	0.36	4.0	0.38	2.5	0.28	-6.9	0.54	0.8	0.13	0.9	0.25	2.2	0.25	2.9	0.36	-4.2	0.52	1.0	0.12	1.2	0.13	0.8	0.29	1.2	0.26								
Calculus	Student	81.9	0.92	0.4	0.09	0.2	0.11	1.7	0.36	15.7	0.89	80.8	0.61	0.3	0.05	0.3	0.07	2.2	0.31	16.4	0.52	80.0	0.72	0.2	0.04	0.3	0.05	2.7	0.30	16.8	0.61								
	Transcript	84.3	1.03	0.1	0.06	#	#	1.0	0.24	14.6	1.00	83.0	0.64	#	0.02	0.1	0.05	1.6	0.27	15.3	0.59	81.5	0.76	#	#	#	0.02	1.6	0.18	16.9	0.68								
	Difference	-2.3	0.46	0.3	0.09	0.2	0.11	0.7	0.20	1.1	0.48	-2.2	0.24	0.2	0.05	0.2	0.05	0.6	0.15	1.2	0.23	-1.5	0.25	0.2	0.04	0.2	0.04	1.0	0.17	#	0.28								
Discrete/finite mathematics	Student	95.7	0.43	0.7	0.13	0.9	0.15	1.1	0.22	1.6	0.28	96.0	0.35	0.4	0.11	0.4	0.09	0.9	0.11	2.2	0.31	94.8	0.42	0.4	0.06	0.6	0.09	1.2	0.12	3.0	0.32								
	Transcript	99.3	0.24	#	#	#	#	0.1	0.08	0.6	0.20	98.3	0.29	#	#	#	0.03	0.2	0.07	1.4	0.26	97.6	0.35	#	#	#	0.02	0.3	0.09	2.1	0.30								
	Difference	-3.6	0.38	0.7	0.13	0.9	0.15	1.0	0.20	1.0	0.21	-2.4	0.23	0.4	0.11	0.4	0.09	0.7	0.12	0.8	0.17	-2.8	0.29	0.4	0.06	0.5	0.09	0.9	0.11	1.0	0.17								
Other mathematics	Student	83.8	0.77	1.7	0.32	1.9	0.24	4.3	0.41	8.3	0.60	82.8	0.83	1.3	0.15	1.9	0.21	4.4	0.34	9.7	0.53	83.2	0.58	1.2	0.11	1.7	0.11	4.3	0.25	9.5	0.37								
	Transcript	97.5	0.40	0.2	0.14	0.4	0.17	0.6	0.17																														

**TABLE E9.** Average NAEP twelfth-grade mathematics assessment scores of high school students, by student-reported and transcript-recorded mathematics courses: 2000, 2005, and 2009

Mathematics course	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.
Basic/general mathematics	278	2.4	273	3.0	<b>-5</b>	2.3	132	1.1	124	2.1	<b>-8</b>	2.0	137	0.8	125	1.0	<b>-12</b>	1.0
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	284	1.7	279	2.6	<b>-5</b>	2.1	139	1.2	128	1.8	<b>-11</b>	1.7	146	0.9	135	1.6	<b>-11</b>	1.6
Introduction to algebra/pre-algebra	278	1.6	275	2.6	-3	2.3	130	0.9	124	1.7	<b>-6</b>	1.6	133	0.7	128	1.4	<b>-5</b>	1.5
Algebra I	296	1.0	297	1.0	<b>2</b>	0.7	145	0.8	145	0.8	1	0.4	147	0.6	147	0.6	0	0.4
Geometry	306	1.0	307	1.1	0	0.4	155	0.7	154	0.7	0	0.3	157	0.7	157	0.7	0	0.2
Algebra II, with or without trigonometry	310	1.1	310	1.1	1	0.5	159	0.7	159	0.8	0	0.3	161	0.7	161	0.7	<b>0</b>	0.2
Trigonometry (as a separate course)	317	1.7	326	3.0	<b>9</b>	2.5	165	1.2	171	1.8	<b>7</b>	1.5	166	1.0	173	1.2	<b>6</b>	1.4
Precalculus/third-year algebra/elementary functions and analysis	324	1.4	326	1.4	<b>2</b>	0.9	175	0.8	174	0.8	0	0.7	177	0.9	175	0.9	<b>-1</b>	0.4
Unified/integrated/sequential mathematics	302	3.4	301	4.2	-1	3.4	148	1.7	149	2.3	1	2.1	150	1.5	152	2.1	2	1.9
Probability/statistics	309	2.9	324	4.0	<b>15</b>	3.4	164	1.6	176	2.0	<b>12</b>	1.4	166	1.3	175	1.4	<b>9</b>	0.9
Calculus	334	2.2	342	1.9	<b>8</b>	1.7	186	1.0	192	0.9	<b>6</b>	0.7	189	1.2	193	1.1	<b>4</b>	0.5
Discrete/finite mathematics	300	4.4	317	6.1	<b>17</b>	6.4	146	3.0	162	3.4	<b>16</b>	3.8	155	2.1	159	1.9	5	2.4
Other mathematics	295	2.1	311	9.1	16	9.1	144	1.3	155	2.7	<b>11</b>	2.7	150	1.0	154	2.1	4	2.1

<sup>1</sup>Reported as two separate categories in 2000. The categories were combined for comparison with 2005 and 2009 data.

NOTE: The abbreviation “s.e.” stands for standard error. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared. Comparisons between years cannot be made because both assessments changed their scales during the ten-year time period (mathematics in 2005, science in 2009).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE E10.** Average NAEP twelfth-grade mathematics assessment scores of high school students, by the highest-level course taken and student-reported and transcript-recorded coursetaking: 2000, 2005, and 2009

Highest-level mathematics course taken	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.
Below algebra I	270	2.3	253	4.6	<b>-18</b>	4.5	114	3.0	99	2.7	<b>-15</b>	3.3	120	2.7	103	2.8	<b>-17</b>	2.8
Algebra I	272	2.0	266	1.7	<b>-7</b>	2.1	114	1.9	114	1.9	0	2.0	119	1.8	115	1.4	<b>-4</b>	1.7
Geometry	280	1.4	276	1.6	<b>-4</b>	1.5	127	1.3	124	1.5	<b>-3</b>	1.2	128	0.8	125	0.9	<b>-3</b>	0.7
Algebra II	293	1.0	291	1.0	-2	1.0	140	0.7	139	0.9	0	0.6	141	0.5	140	0.6	-1	0.4
Advanced mathematics	310	1.2	316	1.5	<b>5</b>	1.0	159	0.7	162	0.8	<b>3</b>	0.7	160	0.6	162	0.7	<b>3</b>	0.4
Calculus	330	2.1	341	1.9	<b>11</b>	1.5	181	1.1	192	0.8	<b>10</b>	0.9	185	1.2	193	1.1	<b>8</b>	0.6

NOTE: The abbreviation “s.e.” stands for standard error. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared. Advanced mathematics includes courses, other than calculus, that are generally taken after algebra II (e.g., AP statistics, trigonometry, precalculus). Comparisons between years cannot be made because both assessments changed their scales during the ten-year time period (mathematics in 2005, science in 2009).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.



# APPENDIX F

## Student-reported and transcript-recorded science coursetaking data tables

**TABLE F1.** Comparison of student-reported and transcript-recorded percentages of high school students taking science courses: 2000, 2005, and 2009

Science course	Percentage of high school students taking science course																	
	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Earth and space science	28.8	2.33	21.4	2.84	<b>-7.4</b>	1.31	36.0	1.34	27.4	1.71	<b>-8.6</b>	0.97	36.5	1.32	28.6	1.79	<b>-7.9</b>	1.52
Life science (other than biology)	32.6	1.07	3.4	0.76	<b>-29.2</b>	1.21	40.2	0.76	3.8	0.44	<b>-36.3</b>	0.92	39.0	1.04	5.3	0.86	<b>-33.7</b>	1.26
Physical science (other than chemistry and physics)	53.9	2.60	49.1	3.38	<b>-4.9</b>	1.87	49.0	1.09	43.1	1.52	<b>-6.0</b>	1.09	49.2	1.13	42.6	1.78	<b>-6.6</b>	1.33
General science <sup>1</sup>	24.4	1.92	14.1	1.78	<b>-10.3</b>	1.82	30.8	1.10	16.7	1.15	<b>-14.1</b>	1.12	20.0	0.79	13.0	1.16	<b>-7.0</b>	1.26
First-year biology	90.8	0.70	92.8	0.95	<b>2.0</b>	0.85	90.5	0.51	91.6	0.80	<b>1.1</b>	0.81	92.1	0.61	95.3	0.79	<b>3.2</b>	0.98
Second-year biology	27.9	1.52	31.4	1.80	<b>3.4</b>	1.42	26.5	0.98	31.0	1.10	<b>4.4</b>	1.26	26.6	0.82	31.7	1.19	<b>5.1</b>	1.11
First-year chemistry	71.2	1.28	68.8	1.53	<b>-2.5</b>	0.66	74.1	0.79	70.0	1.20	<b>-4.0</b>	0.72	76.0	0.95	74.9	1.05	<b>-1.1</b>	0.68
Second-year chemistry	13.3	1.09	7.9	1.13	<b>-5.3</b>	0.72	14.8	0.74	10.0	0.71	<b>-4.8</b>	0.67	14.4	0.74	6.2	0.47	<b>-8.2</b>	0.67
First-year physics	35.7	1.50	33.0	1.61	<b>-2.7</b>	0.70	37.1	1.13	31.1	1.12	<b>-6.0</b>	0.73	42.3	1.26	35.0	1.34	<b>-7.3</b>	0.83
Second-year physics	5.8	0.58	3.6	0.48	<b>-2.3</b>	0.54	6.4	0.46	5.7	0.50	<b>-0.7</b>	0.59	7.6	0.59	5.4	0.69	<b>-2.2</b>	0.60
Science and technology/Engineering and technology <sup>2</sup>	11.6	0.78	1.3	0.28	<b>-10.3</b>	0.80	12.6	0.54	1.6	0.31	<b>-11.1</b>	0.56	14.2	0.88	4.0	0.55	<b>-10.2</b>	0.89
Other science	31.4	1.21	1.7	0.78	<b>-29.6</b>	1.36	30.4	0.80	1.7	0.31	<b>-28.7</b>	0.84	38.0	0.89	2.7	0.47	<b>-35.3</b>	0.86

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as "Science and technology" in 2000 and 2005 and as "Engineering and technology" in 2009. Considered similar categories for trend purposes.

NOTE: The abbreviation "s.e." stands for standard error. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F2. Percentage distribution of high school students by their self-reported and transcript-recorded science coursetaking: 2000, 2005, and 2009**

Science course	Percentage of high school graduates who																							
	Correctly reported taking science course found on their transcripts						Reported taking science course not found on their transcripts						Did not report taking science course found on their transcript						Correctly reported not taking science course not found on their transcripts					
	2000		2005		2009		2000		2005		2009		2000		2005		2009		2000		2005		2009	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Earth and space science	<b>16.4</b>	2.62	21.7	1.52	22.7	1.50	12.3	1.04	14.3	0.73	13.8	1.08	5.0	0.61	5.7	0.48	5.9	0.68	<b>66.3</b>	2.53	58.2	1.49	57.6	1.42
Life science (other than biology)	1.3	0.31	2.3	0.32	2.6	0.57	<b>31.3</b>	1.05	37.9	0.84	36.4	0.99	2.1	0.49	<b>1.6</b>	0.22	2.7	0.47	<b>65.3</b>	1.22	58.3	0.75	58.3	1.06
Physical science (other than chemistry and physics)	<b>41.0</b>	3.28	32.4	1.34	32.1	1.41	<b>12.9</b>	1.31	16.7	0.75	17.1	0.84	8.0	1.19	10.7	0.69	10.5	0.75	38.0	2.66	40.3	1.24	40.3	1.40
General science <sup>1</sup>	7.9	1.32	<b>10.5</b>	0.96	5.8	0.66	16.5	1.61	<b>20.4</b>	0.90	14.2	0.80	6.2	0.77	6.2	0.49	7.2	0.82	69.4	2.24	<b>63.0</b>	1.19	72.8	1.12
First-year biology	87.0	0.97	<b>85.3</b>	0.81	89.2	0.88	3.8	0.65	<b>5.2</b>	0.65	3.0	0.74	5.8	0.49	6.3	0.33	6.2	0.53	<b>3.3</b>	0.60	<b>3.2</b>	0.37	1.7	0.30
Second-year biology	17.2	1.60	15.5	0.82	15.1	0.79	10.7	0.72	11.0	0.53	11.5	0.69	14.2	1.05	15.5	0.90	16.6	0.92	57.9	1.62	58.0	1.00	56.8	1.26
First-year chemistry	<b>66.8</b>	1.47	<b>67.8</b>	1.18	72.5	1.02	4.4	0.61	<b>6.2</b>	0.71	3.5	0.44	1.9	0.19	2.2	0.18	2.4	0.49	<b>26.8</b>	1.33	23.7	0.83	21.6	0.97
Second-year chemistry	6.3	1.02	<b>7.1</b>	0.53	5.5	0.44	<b>7.0</b>	0.50	7.7	0.50	8.9	0.66	1.6	0.50	<b>2.9</b>	0.43	0.8	0.17	85.1	1.19	<b>82.3</b>	0.88	84.9	0.77
First-year physics	30.4	1.63	<b>28.8</b>	1.06	33.8	1.32	<b>5.3</b>	0.52	8.2	0.65	8.5	0.74	<b>2.6</b>	0.59	<b>2.3</b>	0.34	1.2	0.25	<b>61.8</b>	1.52	<b>60.7</b>	1.19	56.5	1.24
Second-year physics	2.1	0.35	2.3	0.22	3.1	0.39	3.8	0.41	4.0	0.38	4.5	0.46	1.5	0.32	3.3	0.43	2.3	0.39	<b>92.7</b>	0.65	90.3	0.63	90.2	0.82
Science and technology/Engineering and technology <sup>2</sup>	<b>0.5</b>	0.17	<b>0.5</b>	0.13	2.2	0.28	11.1	0.76	12.2	0.54	12.0	0.84	<b>0.8</b>	0.17	1.1	0.20	1.8	0.44	<b>87.6</b>	0.79	86.3	0.62	84.0	1.06
Other science	0.9	0.38	<b>0.8</b>	0.14	1.6	0.36	<b>30.5</b>	1.22	<b>29.6</b>	0.79	36.4	0.83	0.8	0.41	0.9	0.19	1.1	0.19	<b>67.8</b>	1.31	<b>68.7</b>	0.82	60.9	0.93

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as “Science and technology” in 2000 and 2005 and as “Engineering and technology” in 2009. Considered similar categories for trend purposes.

NOTE: The abbreviation “s.e.” stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F3.** Percentage of high school students who reported taking science courses that were recorded on their transcripts: 2000, 2005, and 2009

Science course student reported taking	2000				2005				2009			
	Course recorded on student transcript		Course not recorded on student transcript		Course recorded on student transcript		Course not recorded on student transcript		Course recorded on student transcript		Course not recorded on student transcript	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Earth and space science	57.1	5.12	42.9	5.12	60.2	2.50	39.8	2.50	62.1	2.96	37.9	2.96
Life science (other than biology)	4.1	0.94	95.9	0.94	5.7	0.82	94.3	0.82	6.7	1.42	93.3	1.42
Physical science (other than chemistry and physics)	<b>76.1</b>	3.03	23.9	3.03	66.0	1.72	34.0	1.72	65.3	1.89	34.7	1.89
General science <sup>1</sup>	32.3	4.50	67.7	4.50	33.9	2.54	66.1	2.54	29.2	3.03	70.8	3.03
First-year biology	95.8	0.71	4.2	0.71	<b>94.2</b>	0.71	5.8	0.71	96.8	0.80	3.2	0.80
Second-year biology	61.6	3.10	38.4	3.10	58.5	1.73	41.5	1.73	56.9	2.29	43.1	2.29
First-year chemistry	93.8	0.88	6.2	0.88	<b>91.6</b>	0.99	8.4	0.99	95.4	0.58	4.6	0.58
Second-year chemistry	47.3	4.44	52.7	4.44	<b>48.0</b>	2.46	52.0	2.46	38.1	2.73	61.9	2.73
First-year physics	<b>85.2</b>	1.63	14.8	1.63	77.8	1.62	22.2	1.62	79.8	1.73	20.2	1.73
Second-year physics	35.8	4.35	64.2	4.35	36.8	2.94	63.2	2.94	40.8	4.02	59.2	4.02
Science and technology/Engineering and technology <sup>2</sup>	<b>4.0</b>	1.43	96.0	1.43	<b>3.9</b>	1.05	96.1	1.05	15.5	1.95	84.5	1.95
Other science	2.9	1.19	97.1	1.19	2.7	0.46	97.3	0.46	4.2	0.92	95.8	0.92

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as “Science and technology” in 2000 and 2005 and as “Engineering and technology” in 2009. Considered similar categories for trend purposes.

NOTE: The abbreviation “s.e.” stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F4.** Percentage of high school students' transcripts where the recorded science courses were reported by students: 2000, 2005, and 2009

Science course recorded on student transcript	2000				2005				2009			
	Student reported taking course		Student did not report taking course		Student reported taking course		Student did not report taking course		Student reported taking course		Student did not report taking course	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Earth and space science	76.8	3.04	23.2	3.04	79.1	1.55	20.9	1.55	78.9	1.97	21.1	1.97
Life science (other than biology)	38.9	3.93	61.1	3.93	59.3	3.95	40.7	3.95	48.1	6.18	51.9	6.18
Physical science (other than chemistry and physics)	<b>83.6</b>	2.40	16.4	2.40	75.1	1.42	24.9	1.42	75.2	1.34	24.8	1.34
General science <sup>1</sup>	<b>56.0</b>	3.96	44.0	3.96	<b>62.7</b>	2.55	37.3	2.55	43.6	3.51	56.4	3.51
First-year biology	93.7	0.52	6.3	0.52	93.1	0.35	6.9	0.35	93.5	0.55	6.5	0.55
Second-year biology	<b>54.8</b>	3.09	45.2	3.09	50.1	2.15	49.9	2.15	47.6	1.93	52.4	1.93
First-year chemistry	97.2	0.27	2.8	0.27	96.9	0.25	3.1	0.25	96.8	0.65	3.2	0.65
Second-year chemistry	79.3	5.76	20.7	5.76	<b>70.9</b>	3.34	29.2	3.34	87.9	2.50	12.1	2.50
First-year physics	<b>92.2</b>	1.78	7.8	1.78	<b>92.7</b>	1.02	7.3	1.02	96.5	0.71	3.5	0.71
Second-year physics	58.7	6.68	41.3	6.68	<b>41.3</b>	3.61	58.7	3.61	57.8	3.56	42.2	3.56
Science and technology/ Engineering and technology <sup>2</sup>	35.7	8.25	64.3	8.25	<b>31.3</b>	4.33	68.7	4.33	52.4	6.91	47.6	6.91
Other science	53.1	4.78	46.9	4.78	47.8	4.07	52.2	4.07	57.0	6.10	43.0	6.10

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as "Science and technology" in 2000 and 2005 and as "Engineering and technology" in 2009. Considered similar categories for trend purposes.

NOTE: The abbreviation "s.e." stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F5.** Percentage of high school students' transcripts where the recorded science courses were reported by students, by reported most recent grade level taken: 2000, 2005, and 2009

Science course recorded on student transcript and reported by student	2000				2005				2009			
	Student and transcript agree on most recent grade level taken		Student and transcript disagree on most recent grade level taken		Student and transcript agree on most recent grade level taken		Student and transcript disagree on most recent grade level taken		Student and transcript agree on most recent grade level taken		Student and transcript disagree on most recent grade level taken	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Earth and space science	88.7	1.53	11.3	1.53	84.7	1.01	15.3	1.01	85.8	1.38	14.2	1.38
Life science (other than biology)	<b>68.5</b>	6.13	31.5	6.13	46.8	4.30	53.2	4.30	44.3	9.60	55.7	9.60
Physical science (other than chemistry and physics)	<b>82.3</b>	1.36	17.7	1.36	78.2	1.08	21.8	1.08	74.2	1.81	25.8	1.81
General science <sup>1</sup>	64.2	4.68	35.8	4.68	67.9	1.96	32.1	1.96	70.0	3.85	30.0	3.85
First-year biology	82.9	1.01	17.1	1.01	81.6	0.68	18.4	0.68	81.8	0.76	18.2	0.76
Second-year biology	75.5	1.98	24.5	1.98	76.3	1.53	23.7	1.53	74.3	2.01	25.7	2.01
First-year chemistry	<b>92.7</b>	0.51	7.3	0.51	92.4	0.50	7.6	0.50	90.8	0.63	9.2	0.63
Second-year chemistry	96.1	0.87	3.9	0.87	93.9	0.98	6.1	0.98	96.7	1.19	3.3	1.19
First-year physics	95.5	0.79	4.5	0.79	96.0	0.51	4.0	0.51	94.3	1.13	5.7	1.13
Second-year physics	96.9	1.81	3.1	1.81	95.3	1.59	4.7	1.59	95.8	1.22	4.2	1.22
Science and technology/Engineering and technology <sup>2</sup>	<b>35.7</b>	12.00	64.3	12.00	55.8	10.26	44.2	10.26	66.0	4.31	34.0	4.31
Other science	40.6	13.40	59.4	13.40	61.2	8.15	38.8	8.15	41.2	10.11	58.8	10.11

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as "Science and technology" in 2000 and 2005 and as "Engineering and technology" in 2009. Considered similar categories for trend purposes.

NOTE: The abbreviation "s.e." stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F6.** Percentage distribution of overall number of differences between student-reported and transcript-recorded science courses taken: 2000, 2005, and 2009

Differences	Science					
	2000		2005		2009	
	Percent	s.e.	Percent	s.e.	Percent	s.e.
0	<b>26.4</b>	1.28	19.4	0.73	18.8	0.85
1	<b>20.1</b>	0.80	17.9	0.54	17.9	0.69
2	23.4	0.67	24.7	0.63	25.4	0.88
3	<b>15.2</b>	0.60	16.9	0.54	17.9	0.73
4	<b>8.4</b>	0.50	11.2	0.40	10.2	0.55
5 or more	<b>6.5</b>	0.51	9.9	0.51	9.8	0.80

NOTE: The abbreviation “s.e.” stands for standard error. A difference between student-reported and transcript-recorded courses occurs when a student either reports a course not recorded on his or her transcript or did not report taking a course recorded on his or her transcript. Details may not sum to total because of rounding. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2009 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F7.** Highest-level science course taken by high school students, based on student-reported and transcript-recorded data: 2000, 2005, and 2009

Highest-level science course taken	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Survey science	2.0	0.27	2.2	0.50	0.2	0.39	1.8	0.19	1.9	0.27	0.1	0.29	1.1	0.37	1.0	0.27	-0.1	0.47
Earth science	2.0	0.22	0.4	0.11	<b>-1.6</b>	0.21	2.3	0.20	0.7	0.15	<b>-1.7</b>	0.22	1.4	0.18	0.2	0.08	<b>-1.2</b>	0.17
Biology	13.4	0.77	17.6	0.92	<b>4.2</b>	0.68	10.3	0.51	14.9	0.66	<b>4.6</b>	0.51	9.5	0.70	14.8	0.87	<b>5.2</b>	0.53
Chemistry	22.0	1.07	23.7	1.10	<b>1.7</b>	0.72	21.8	0.84	24.9	1.04	<b>3.1</b>	0.72	22.9	0.81	24.0	0.90	1.1	0.74
Physics	21.2	1.14	18.7	1.43	<b>-2.5</b>	0.85	22.0	0.74	18.2	0.77	<b>-3.8</b>	0.63	24.5	0.87	21.5	0.96	<b>-3.0</b>	0.79
Advanced science	39.4	1.48	37.3	1.74	-2.1	1.42	41.7	1.04	39.4	1.10	-2.3	1.23	40.6	0.94	38.6	1.23	-2.1	1.06

NOTE: The abbreviation “s.e.” stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared. Survey science includes life science, physical science, and general science courses. Advanced science courses are courses that contain advanced content (e.g., AP biology, IB chemistry, AP physics) or are considered second-year courses (e.g., chemistry II, advanced biology).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

**TABLE F8. Percentage distribution of high school students across the most recent grade levels selected science courses were taken, based on student-reported and transcript-recorded data: 2000, 2005, and 2009**

Science course	Data Source	2000										2005										2009									
		Did not take course		Most recently took in ninth grade		Most recently took in tenth grade		Most recently took in eleventh grade		Most recently took in twelfth grade		Did not take course		Most recently took in ninth grade		Most recently took in tenth grade		Most recently took in eleventh grade		Most recently took in twelfth grade		Did not take course		Most recently took in ninth grade		Most recently took in tenth grade		Most recently took in eleventh grade		Most recently took in twelfth grade	
		Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Earth and space science	Student	71.2	2.33	17.8	2.19	3.9	0.39	3.7	0.47	3.3	0.32	64.0	1.34	21.0	1.28	5.1	0.31	5.1	0.36	4.8	0.37	64.3	1.35	19.7	1.15	6.7	0.76	5.1	0.51	4.1	0.38
	Transcript	78.6	2.84	11.5	2.55	2.0	0.33	3.6	0.62	4.3	0.52	72.6	1.71	14.4	1.44	2.8	0.27	5.2	0.48	5.0	0.47	71.5	1.79	12.1	1.27	5.5	0.85	5.3	0.70	5.7	0.50
	Difference	<b>-7.4</b>	1.31	<b>6.3</b>	0.94	<b>1.9</b>	0.38	0.1	0.41	<b>-1.0</b>	0.44	<b>-8.6</b>	0.97	<b>6.6</b>	0.73	<b>2.4</b>	0.24	-0.2	0.29	-0.2	0.32	<b>-7.1</b>	1.47	<b>7.7</b>	1.09	<b>1.2</b>	0.36	-0.2	0.56	<b>-1.6</b>	0.44
Life science (other than biology)	Student	67.4	1.07	14.9	0.79	8.1	0.40	4.8	0.48	4.8	0.35	59.8	0.76	14.0	0.48	12.4	0.45	7.4	0.34	6.4	0.32	61.5	1.05	13.5	0.61	11.1	0.71	7.1	0.54	6.8	0.54
	Transcript	96.6	0.76	0.1	0.02	0.2	0.10	1.6	0.66	1.6	0.35	96.2	0.44	0.3	0.15	0.4	0.09	1.3	0.21	1.9	0.30	94.7	0.86	0.2	0.15	0.3	0.10	2.1	0.53	2.6	0.39
	Difference	<b>-29.2</b>	1.21	<b>14.8</b>	0.79	<b>7.9</b>	0.40	<b>3.2</b>	0.61	<b>3.2</b>	0.46	<b>-36.3</b>	0.92	<b>13.7</b>	0.51	<b>12.1</b>	0.45	<b>6.1</b>	0.34	<b>4.4</b>	0.41	<b>-33.3</b>	1.26	<b>13.3</b>	0.59	<b>10.8</b>	0.70	<b>5.0</b>	0.71	<b>4.2</b>	0.67
Physical science (other than chemistry and physics)	Student	46.1	2.60	35.6	2.74	9.7	0.85	5.3	0.37	3.3	0.28	51.0	1.09	27.9	1.13	9.1	0.38	7.9	0.39	4.1	0.28	51.2	1.13	24.5	1.14	10.5	0.72	8.9	0.38	4.8	0.47
	Transcript	50.9	3.38	39.1	3.13	5.4	0.89	2.8	0.42	1.8	0.41	56.9	1.52	31.5	1.28	5.9	0.44	3.6	0.37	2.1	0.20	57.4	1.78	29.5	1.57	7.9	0.88	3.6	0.40	1.6	0.23
	Difference	<b>-4.9</b>	1.87	<b>-3.5</b>	1.58	<b>4.4</b>	0.57	<b>2.5</b>	0.41	<b>1.5</b>	0.48	<b>-6.0</b>	1.09	<b>-3.6</b>	0.87	<b>3.3</b>	0.38	<b>4.3</b>	0.44	<b>2.0</b>	0.31	<b>-6.2</b>	1.32	<b>-4.9</b>	1.12	<b>2.6</b>	0.90	<b>5.3</b>	0.49	<b>3.3</b>	0.46
General science <sup>1</sup>	Student	75.6	1.92	14.9	1.79	5.0	0.37	2.3	0.30	2.1	0.33	69.2	1.10	18.0	0.93	6.6	0.42	3.6	0.27	2.6	0.25	80.9	0.78	12.5	0.79	3.1	0.26	2.2	0.19	1.4	0.14
	Transcript	85.9	1.78	8.0	1.38	2.9	0.61	2.0	0.43	1.3	0.31	83.3	1.15	8.6	0.92	4.0	0.53	2.1	0.34	1.9	0.31	87.1	1.16	8.4	0.97	2.0	0.34	1.6	0.29	0.9	0.19
	Difference	<b>-10.3</b>	1.82	<b>7.0</b>	1.69	<b>2.1</b>	0.50	0.3	0.45	<b>0.8</b>	0.32	<b>-14.1</b>	1.12	<b>9.4</b>	1.02	<b>2.6</b>	0.36	<b>1.5</b>	0.35	<b>0.7</b>	0.23	<b>-6.3</b>	1.26	<b>4.1</b>	1.04	<b>1.1</b>	0.36	<b>0.6</b>	0.27	0.5	0.26
First-year biology	Student	9.2	0.70	30.5	1.88	54.5	2.02	4.7	0.48	1.2	0.20	9.5	0.51	32.2	1.30	51.0	1.41	5.5	0.37	1.7	0.20	7.9	0.61	41.5	1.46	45.4	1.48	4.6	0.51	0.6	0.09
	Transcript	7.2	0.95	26.3	2.03	53.9	2.19	8.1	0.59	4.6	0.56	8.4	0.80	25.6	1.27	52.1	1.38	8.8	0.45	5.1	0.39	4.7	0.79	33.8	1.52	48.7	1.57	7.9	0.68	4.9	0.43
	Difference	<b>2.0</b>	0.85	<b>4.2</b>	0.65	0.6	1.06	<b>-3.4</b>	0.63	<b>-3.5</b>	0.59	1.1	0.81	<b>6.7</b>	0.56	-1.1	0.68	<b>-3.3</b>	0.38	<b>-3.4</b>	0.38	<b>3.2</b>	0.98	<b>7.6</b>	0.99	<b>-3.3</b>	0.92	<b>-3.2</b>	0.45	<b>-4.3</b>	0.41
Second-year biology	Student	72.1	1.52	2.0	0.23	8.1	0.85	10.2	0.76	7.6	0.88	73.5	0.98	2.3	0.21	7.6	0.54	9.5	0.60	7.1	0.41	73.6	0.82	3.6	0.51	7.4	0.52	8.3	0.65	7.1	0.54
	Transcript	68.6	1.80	0.6	0.18	4.0	0.76	10.6	0.86	16.2	1.20	69.0	1.10	0.9	0.26	3.6	0.48	11.6	0.71	14.9	0.63	68.2	1.20	0.2	0.05	2.0	0.30	11.0	0.73	18.6	0.85
	Difference	<b>3.4</b>	1.42	<b>1.4</b>	0.23	<b>4.0</b>	0.68	-0.3	0.69	<b>-8.6</b>	1.00	<b>4.4</b>	1.26	<b>1.4</b>	0.35	<b>4.0</b>	0.62	<b>-2.1</b>	0.56	<b>-7.7</b>	0.62	<b>5.4</b>	1.11	<b>3.5</b>	0.51	<b>5.3</b>	0.51	<b>-2.7</b>	0.50	<b>-11.5</b>	0.80
First-year chemistry	Student	28.8	1.28	1.7	0.25	21.5	1.44	41.3	1.30	6.7	0.54	25.9	0.79	2.4	0.45	22.2	1.06	41.0	1.02	8.4	0.52	24.1	0.95	2.5	0.33	28.3	1.17	39.4	1.12	5.7	0.41
	Transcript	31.2	1.53	0.5	0.12	19.4	1.48	41.3	1.36	7.6	0.55	30.0	1.20	1.0	0.45	19.6	1.08	40.4	1.19	9.2	0.51	25.1	1.05	0.7	0.21	25.5	1.31	41.0	1.26	7.6	0.62
	Difference	<b>-2.5</b>	0.66	<b>1.2</b>	0.23	<b>2.1</b>	0.38	#	0.55	<b>-0.8</b>	0.24	<b>-4.0</b>	0.72	<b>1.4</b>	0.28	<b>2.7</b>	0.37	0.7	0.47	<b>-0.8</b>	0.25	-1.1	0.68	<b>1.8</b>	0.25	<b>2.8</b>	0.47	<b>-1.6</b>	0.58	<b>-1.9</b>	0.49
Second-year chemistry	Student	86.7	1.09	0.2	0.06	1.5	0.19	6.5	0.90	5.0	0.49	85.2	0.74	0.6	0.09	1.6	0.28	6.8	0.43	5.8	0.37	85.8	0.75	0.7	0.17	1.9	0.19	7.1	0.55	4.4	0.33
	Transcript	92.1	1.13	#	0.01	0.7	0.15	4.4	0.97	2.9	0.50	90.0	0.71	#	0.01	1.4	0.34	4.5	0.43	4.0	0.36	93.8	0.47	#	#	0.3	0.11	2.9	0.28	3.0	0.30
	Difference	<b>-5.3</b>	0.72	<b>0.2</b>	0.06	<b>0.9</b>	0.23	<b>2.2</b>	0.52	<b>2.1</b>	0.24	<b>-4.8</b>	0.67	<b>0.6</b>	0.09	0.2	0.38	<b>2.3</b>	0.34	<b>1.8</b>	0.25	<b>-8.0</b>	0.67	<b>0.7</b>	0.17	<b>1.6</b>	0.21	<b>4.2</b>	0.51	<b>1.4</b>	0.20
First-year physics	Student	64.3	1.50	1.9	0.49	2.1	0.42	12.4	1.04	19.3	1.21	62.9	1.13	2.8	0.42	2.0	0.33	12.9	0.83	19.4	0.70	57.8	1.26	3.7	0.45	3.4	0.41	17.6	1.07	17.7	0.90
	Transcript	67.0	1.61	1.2	0.51	1.2	0.30	11.9	1.06	18.7	1.20	68.9	1.12	1.4	0.35	1.3	0.36	11.3	0.88	17.1	0.63	65.0	1.34	1.4	0.32	1.6	0.32	15.3	1.07	16.7	0.92
	Difference	<b>-2.7</b>	0.70	<b>0.7</b>	0.23	<b>0.9</b>	0.28	0.5	0.38	0.6	0.41	<b>-6.0</b>	0.73	<b>1.4</b>	0.34	<b>0.7</b>	0.21	<b>1.6</b>	0.30	<b>2.3</b>	0.41	<b>-7.2</b>	0.83	<b>2.2</b>	0.42	<b>1.8</b>	0.25	<b>2.2</b>	0.37	1.0	0.72
Second-year physics	Student	94.2	0.58	0.4	0.10	0.4	0.09	1.6	0.29	3.5	0.35	93.6	0.46	0.5	0.08	0.8	0.20	1.3	0.13	3.7	0.35	92.5	0.59	1.0	0.32	0.7	0.15	1.8	0.20	4.0	0.43
	Transcript	96.4	0.48	#	0.02	#	0.03	1.0	0.28	2.6	0.31	94.3	0.50	#	0.02	#	0.01	1.3	0.18	4.3	0.41	94.6	0.69	0.1	0.06	0.1	0.03	1.2	0.24	4.0	0.71
	Difference	<b>-2.3</b>	0.54	<b>0.3</b>	0.10	<b>0.4</b>	0.09	<b>0.6</b>	0.26	<b>0.9</b>	0.36	-0.7	0.59	<b>0.5</b>	0.08	<b>0.8</b>	0.20	#	0.24	-0.6	0.42	<b>-2.1</b>	0.60	<b>0.9</b>	0.32	<b>0.6</b>	0.15	<b>0.5</b>	0.27	0.1	0.44
Science and technology/Engineering and technology <sup>2</sup>	Student	88.4	0.78	2.9	0.47	1.7	0.22	3.3	0.25	3.6	0.36	87.4	0.54	3.3	0.33	2.4	0.20	3.1	0.25	3.9	0.28	86.8	0.81	3.8	0.41	2.0	0.16	2.6	0.23	4.8	0.48
	Transcript	98.7	0.28	0.2	0.09	0.3	0.20	0.4	0.11	0.4	0.13	98.4	0.31	0.4	0.10	0.3	0.09	0.4	0.10	0.5	0.13	96.1	0.55	0.6	0.12	0.6	0.14	1.4	0.42	1.3	0.20
	Difference	<b>-10.3</b>	0.80	<b>2.7</b>	0.49	<b>1.4</b>	0.31	<b>2.9</b>	0.29	<b>3.2</b>	0.35	<b>-11.1</b>	0.56	<b>3.0</b>	0.35	<b>2.1</b>	0.21	<b>2.7</b>	0.26	<b>3.4</b>	0.29	<b>-9.3</b>	0.84	<b>3.2</b>	0.42	<b>1.4</b>	0.18	<b>1.2</b>	0.40	<b>3.5</b>	0.48
Other science	Student	68.6	1.21	1.7	0.23	2.7	0.38	8.5	0.66	18.5	1.00	69.6	0.80	1.9	0.23	2.8	0.21	8.8	0.42	16.9	0.65	63.3	0.97	2.5	0.44	3.1	0.47	10.1	0.49	21.1	0.78
	Transcript	98.3	0.78	0.9	0.60	0.1	0.04	0.1	0.09	0.6	0.21	98.3	0.31	0.4	0.10	0.3	0.07	0.2	0.06	0.8	0.28	97.3	0.46	1.1	0.39	0.2	0.10	0.6	0.09	0.8	0.16
	Difference	<b>-29.6</b>	1.36	0.8	0.63	<b>2.6</b>	0.38	<b>8.3</b>	0.68	<b>17.9</b>	0.98	<b>-28.7</b>	0.84	<b>1.5</b>	0.24	<b>2.5</b>	0.21	<b>8.6</b>	0.42	<b>16.1</b>	0.67	<b>-34.1</b>	0.96	<b>1.5</b>	0.59	<b>2.9</b>	0.48	<b>9.5</b>	0.50	<b>20.2</b>	0.76

# Rounds to zero.

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

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**TABLE F9.** Average NAEP twelfth-grade science assessment scores of high school students, by student-reported and transcript-recorded science courses: 2000, 2005, and 2009

Science course	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.
Earth and space science	142	1.8	144	2.2	1	1.2	146	0.9	148	1.0	<b>2</b>	0.6	149	1.2	147	1.7	-1	1.3
Life science (other than biology)	140	1.4	156	3.7	<b>17</b>	3.6	142	1.0	148	2.4	<b>6</b>	2.3	145	1.0	162	5.3	<b>17</b>	5.3
Physical science (other than chemistry and physics)	144	1.2	145	1.2	1	0.8	144	0.9	146	1.0	<b>2</b>	0.6	147	1.1	146	1.4	-1	0.9
General science <sup>1</sup>	141	1.9	137	3.0	-4	2.4	143	1.4	138	2.1	<b>-5</b>	1.8	148	1.6	145	2.5	-3	2.4
First-year biology	150	0.9	149	0.9	<b>-1</b>	0.3	152	0.7	150	0.7	<b>-2</b>	0.2	154	0.8	152	0.8	<b>-1</b>	0.3
Second-year biology	150	1.3	158	1.2	<b>8</b>	1.1	150	1.1	159	0.9	<b>9</b>	1.0	154	1.7	164	1.2	<b>10</b>	1.5
First-year chemistry	157	1.0	157	1.0	#	0.3	156	0.8	156	0.8	#	0.3	158	0.9	158	0.9	#	0.4
Second-year chemistry	155	2.1	173	2.5	<b>17</b>	2.2	158	1.6	176	1.7	<b>18</b>	1.6	158	2.4	188	1.9	<b>29</b>	2.1
First-year physics	165	1.2	166	1.1	1	0.9	163	0.9	163	1.0	1	0.8	166	1.0	168	1.2	<b>2</b>	0.6
Second-year physics	155	4.2	185	3.7	<b>30</b>	3.6	153	2.2	181	1.8	<b>27</b>	2.4	161	3.7	191	2.8	<b>29</b>	4.2
Science and technology/ Engineering and technology <sup>2</sup>	146	2.3	162	5.8	<b>16</b>	5.5	148	1.6	164	5.3	<b>16</b>	5.0	155	2.2	154	7.3	-2	7.7
Other science	150	1.2	161	8.5	11	8.2	150	0.8	150	4.2	#	4.1	153	1.2	164	5.6	10	5.6

# Rounds to zero.

<sup>1</sup> Includes integrated/unified science courses, which were reported separately in 2000 and 2005.

<sup>2</sup> Reported as “Science and technology” in 2000 and 2005 and as “Engineering and technology” in 2009. Considered similar categories for trend purposes.

NOTE: The abbreviation “s.e.” stands for standard error. Details may not sum to total because of rounding. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared. Comparisons between years cannot be made because both assessments changed their scales during the ten-year time period (mathematics in 2005, science in 2009).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009

**TABLE F10.** Average NAEP twelfth-grade science assessment scores of high school students, by the highest-level course taken and student-reported and transcript-recorded coursetaking: 2000, 2005, and 2009

Highest-level science course taken	2000						2005						2009					
	Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference		Student-reported		Transcript-recorded		Difference	
	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.
Survey science	115	3.2	109	4.3	-6	4.3	120	3.5	109	3.8	<b>-11</b>	3.9	114	10.9	130	7.4	15	12.9
Earth science	116	3.5	100	10.9	-16	9.5	122	2.3	128	5.8	7	5.5	123	3.9	120	14.5	-4	13.5
Biology	129	1.5	125	1.4	<b>-4</b>	1.1	134	1.0	128	1.1	<b>-6</b>	1.2	134	1.9	129	1.6	<b>-5</b>	1.3
Chemistry	147	1.3	141	1.6	<b>-6</b>	0.9	147	0.9	142	1.1	<b>-5</b>	0.8	146	1.3	141	1.2	<b>-5</b>	0.9
Physics	158	1.3	157	1.7	-1	1.5	157	1.0	156	1.4	0	1.0	160	1.4	156	2.0	-3	1.9
Advanced science	153	1.3	159	1.2	<b>6</b>	1.0	154	1.0	162	0.8	<b>7</b>	0.8	159	1.3	167	1.0	<b>8</b>	1.2

NOTE: The abbreviation “s.e.” stands for standard error. A bolded value indicates a significant gap; i.e., a statistically significant difference ( $p < .05$ ) between the two subgroups being compared. Survey science includes life science, physical science, and general science courses. Advanced science courses are courses that contain advanced content (e.g., AP biology, IB chemistry, AP physics) or are considered second-year courses (e.g., chemistry II, advanced biology). Comparisons between years cannot be made because both assessments changed their scales during the ten-year time period (mathematics in 2005, science in 2009).

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), High School Transcript Study (HSTS), 2000, 2005, 2009.

# APPENDIX G

## Comparison of student-reported mathematics coursetaking: 2000-2013

**TABLE G1.** Percentages of high school students who reported taking mathematics courses: NAEP 2000, 2005, 2009, and 2013

Mathematics course	Percentage of twelfth-grade students taking mathematics courses while in high school							
	2000		2005		2009		2013	
	Percent	s.e.	Percent	s.e.	Percent	s.e.	Percent	s.e.
Basic/general mathematics	<b>11</b>	0.6	<b>21</b>	0.6	<b>19</b>	0.4	16	0.3
Tech-prep/business/consumer/applied mathematics <sup>1</sup>	26	1.1	<b>28</b>	0.7	27	0.5	26	0.4
Introduction to algebra/pre-algebra	<b>32</b>	0.9	<b>32</b>	0.8	<b>28</b>	0.5	24	0.5
Algebra I	<b>71</b>	1.1	<b>71</b>	0.6	68	0.7	67	0.5
Geometry	<b>86</b>	0.7	<b>87</b>	0.5	<b>89</b>	0.5	91	0.4
Algebra II, with or without trigonometry	<b>79</b>	0.8	<b>80</b>	0.6	<b>83</b>	0.5	88	0.4
Trigonometry (as a separate course)	<b>26</b>	1.4	<b>24</b>	0.8	<b>23</b>	0.9	21	0.7
Pre-calculus/third-year algebra/elementary functions and analysis <sup>2</sup>	<b>37</b>	1.4	<b>38</b>	0.9	41	0.7	43	0.7
Unified/integrated/sequential mathematics <sup>3</sup>	10	1.0	11	0.7	10	0.4	—	—
First-year integrated mathematics	—	—	—	—	—	—	11	0.4
Second-year integrated mathematics	—	—	—	—	—	—	8	0.5
Third-year integrated mathematics	—	—	—	—	—	—	6	0.4
Fourth-year integrated mathematics	—	—	—	—	—	—	4	0.2
Probability/statistics	<b>17</b>	1.1	<b>16</b>	0.7	<b>18</b>	0.5	20	0.6
Calculus	<b>18</b>	0.8	<b>19</b>	0.5	19	0.8	20	0.5
Discrete/finite mathematics <sup>4</sup>	4	0.4	4	0.3	5	0.4	—	—
Other mathematics	<b>16</b>	0.7	<b>17</b>	0.7	<b>18</b>	0.5	20	0.5

<sup>1</sup>Reported as two separate categories in 2000. The categories were combined for comparison with 2005, 2009, and 2013 data.

<sup>2</sup>Redefined as “Pre-calculus/introductory analysis” in 2013. The categories are assumed to be comparable for this table.

<sup>3</sup>Separated into four categories in 2013 based on year of course.

<sup>4</sup>Category was dropped in 2013.

NOTE: The abbreviation “s.e.” stands for standard error. A bolded value indicates a statistically significant difference ( $p < .05$ ) with the associated 2013 value.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2000, 2005, 2009, 2013.



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